



Co-funded by the  
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of the European Union

# Educate for future **EDU4future**



## **IO 4: RECOMMENDATIONS**

**version (EN)**

HOW ARE INDUSTRY 4.0 REQUIREMENTS IMPLEMENTED IN THE  
VOCATIONAL EDUCATION AND TRAINING SYSTEMS OF THE  
PARTNERSHIP'S COUNTRIES?

Project No. 2020-1-SK01-KA202-078375

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## Foreword

The transformation of European economies under the influence of digitalisation, automation and robotics is becoming increasingly intense in the 21st century. This 4th industrial revolution has been known for almost a decade as Industry 4.0. Some technological trends have been further accelerated under the influence of the Covid-19 pandemic. New occupations are emerging, some that have become obsolete are disappearing, but above all most occupations are being internally transformed and absorbing new technologies and practices. It turns out that without adequately skilled professionals, digital transformation faces one of its limits. In other words, high-quality, modern, and responsive vocational education and training is one of the conditions for a successful digital transformation.

in the EDU4future project we are trying to answer the overarching question: How are the requirements of Industry 4.0 implemented in different European vocational education systems?

For this purpose, the project developed a multi-stage approach, starting from the definition of a jointly agreed methodology which was used for the transnational investigation of key aspects of the VET systems in the partnership countries. On this basis, country reports and a collection of good practice examples were prepared for each of the partner regions. In the next step, the results obtained from the country reports were summarised and further analysed in a transnational comparison which revealed an array of significant differences in the VET structures and operational processes of the participating regions.

Building upon these project outputs, it is now the goal of this Recommendations report (Intellectual Output IO4 of the EDU4future project) to analyse all partners' inputs from an aggregated perspective and develop shared conclusions and recommendations reflecting the discussion points, learnings and suggestions developed during project implementation at the transnational partnership level. Further, the specific potential for the improvement of the VET systems and programmes will be presented and discussed in individual partner country chapters.

While following these project goals, the EDU4future partnership is aware that the Recommendations report also pictures the constellation of the project partnership, which involves representatives of different VET stakeholder organisations, namely VET schools and further education experts, labour market analysts and regional development and innovation intermediaries under the lead of a regional chamber of commerce. The specific viewing angle of the EDU4future consortium provides valuable insights into the real challenges of bottom-up operation under the given VET system framework conditions.

The EDU4future Recommendations report benefits from its transnational preparation process and the operational experience of the involved regional project partners. Within the frame of the EDU4future project, the EDU4future Recommendations report is discussed and validated in cooperation with experts and stakeholders from regional VET system networks. Beyond the project lifetime, it is the intention of the project consortium to deliver the Recommendations report providing a useful input for further discussion among the stakeholders of vocational education and training at the regional, national, and transnational level and to contribute to the continuous improvement of the VET system to meet the challenges of digital transformation and Industry 4.0.

## 1. General recommendations of the EDU4future consortium to improve the VET system in line with the requirements of Industry 4.0 and digitalisation

All suggested recommendations are based on the key findings presented in the country reports of the EDU4future partners (IO2) which were further analysed in the comparative analysis (IO3). As described in the methodology chapter in Annex I, the compiled recommendations of the EDU4future partnership are grouped in four thematic clusters.

The reasoning behind each suggested recommendation is briefly explained upfront before presenting the “short version” of the recommendation in a textbox.

The textboxes include the basic argumentation of the recommendation in question together with some explanatory remarks in a generalised form to allow for their easy use of each of the recommendations as a strategic input in presentations and discussions with VET system stakeholders.

### *VET programmes: Content adaptation and review procedures*

In the EDU4future comparative analysis of country reports (IO3), the specific competences to succeed in an Industry 4.0 work environment are categorised in four thematic dimensions<sup>1</sup>, namely technical competences, data and IT competences, social competences, and personal competences, each of them described by a list of single topics. The partners’ assessment to which extent these topics are addressed in the existing VET programmes indicates a substantial demand for widening and/or upgrading of VET programmes.

As far as the technological competences are concerned, the implementation of Industry 4.0 concepts in high-tech companies requires advanced competences of the specialised workforce, depending on the concrete industrial application. On the other hand, there is a wide range of occupational fields in which a broad understanding of digital basics is required as a general background for qualified work. Therefore, up-to-date VET programmes need to fulfil the double function of equipping all learners with profound basic competences and skills in IT and digital applications while providing specialised VET trainees with high-level programming and operating knowledge and competences to work in an advanced Industry 4.0 environment.

In this context, partners from several project regions expressed their concerns that learners entering VET programmes often lack basic digital competences (as well as basic competences in STEM) although everyday skills such as the use of mobile devices and some superficial internet functionalities seem to prove the opposite. Consequently, there is a demand for broadening the basic content of VET programmes, e.g., by implementing basic modules in IT and STEM, as a cross-cutting topic and foundation for more specific and advanced VET modules which address the specifics of different professional fields.

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<sup>1</sup> Schmid (2017), [What type of competencies will Industry 4.0 require?](#)



### Recommendation #1: Focus on basic competences in IT and STEM

- ➔ The EDU4future partnership recommends paying special attention to the facilitation of profound and broad basic competences in IT and STEM at the beginner level of VET programmes as a building block for an advanced specialisation in various professional fields

All partner regions identified shortcomings in the existing VET programmes concerning the social and personal competences required for successful integration of digital work processes and Industry 4.0 applications. Depending on the VET models in place, therefore, the approach for integrating social and personal competences in the VET programmes needs to be negotiated between VET schools and other stakeholders (companies, other training providers).

In some cases, the existing VET schools and their teaching staff may be challenged by the request for widening the existing VET programmes to address social and personal competence topics as a cross-cutting topic or additional teaching subject. New approaches for addressing these topics should be developed in a dialogue with training experts that are specialised in the field of social and individual competence development and with corporate in-house trainers experienced in the social integration of young workers.

### Recommendation #2: Balancing of technical and non-technical competences

- ➔ The EDU4future partnership recommends integrating non-technical competences (i.e., social and personal competences) in the existing and newly defined VET programmes, taking into consideration the framework conditions of the VET models in place and the potential cooperation between VET schools and other relevant VET actors (companies, specialised training providers)

Several project partner regions addressed the need for a closer cooperation with stakeholders from regional lead industries in the development of VET programmes. However, more intensive cooperation during the definition of VET programme content requires adequate mechanisms for balancing the thematic composition of VET programmes covering the demand of a wide scope of target industries. The existing approaches for an institutionalised involvement of industrial stakeholders in terms of consultative boards and committees which are implemented in a dual VET system context should be discussed and adapted to the regional framework conditions of countries with less developed industry involvement in the VET system.

For an industry-led innovation of existing VET programmes, both school-based and dual VET system offer a certain degree of flexibility of VET schools and/or work-based learning in the involved companies which can be used for piloting new or adapted VET modules. Regional networks of VET stakeholders, including VET schools and employer networks, could set up testbeds for the piloting of innovative training courses. However, innovative actions going beyond the regular VET programmes require adequate resources in terms of training and evaluation staff and dedicated funds.



### Recommendation #3: Industry involvement in the content definition of VET programmes

- ➔ The EDU4future partnership recommends establishing adequate institutional framework conditions for VET programme innovation involving regional VET stakeholder networks (VET schools + companies)

All EDU4future partners are aware and agree about the importance of regular monitoring procedures and periodic reviews of VET programmes to assess their efficiency, improve the evidence base, and ensure a better comparability of programmes regarding their learning outcomes and the adequacy of VET content for addressing changing labour market requirements and emerging technological innovation.

In those partner countries that already implement regular review regimes the schedules for the revision of VET programmes range between four and five years. However, in these regions the low level of involvement and consideration of VET institutions' needs (incl. students, teachers & staff, available infrastructure, etc.) is a point of criticism (e.g., in DE). At the same time, in some other partner regions (e.g., in CZ and IT) the review procedures and monitoring structures are not yet fully established and remain under discussion. For the future, partners consider it necessary to come to a "close-to-realtime" monitoring of VET programmes to keep pace with the accelerating speed of technological innovation regarding Industry 4.0 applications and the latest need of labour markets.

### Recommendation #4: VET programme reviews and monitoring procedures

- ➔ The EDU4future partnership recommends establishing tight schedules for VET programme reviews and monitoring cycles for VET programmes focussed on Industry 4.0 and digitalisation to obtain an up-to-date evidence basis for the continuous improvement of the relevant VET programmes and keep pace with technological innovation

### *VET schools: Teaching staff, teaching approaches and infrastructure*

Generally, partners from all project regions share the finding that many VET institutions struggle to implement VET system changes, particularly with the transformation demand brought about by Industry 4.0 technologies and their applications. VET institutions need support and funding for translating the requirements of new or substantially adapted VET programmes into manageable operational procedures and teaching modules. New challenges in teaching need to be reflected in the provision of adequate resources for infrastructure, staff, and technology to become reality in VET schools.

To address all relevant competence dimensions needed to master digital transition, in particular, Industry 4.0 topics, further qualification and upskilling of VET teachers and trainers is necessary to ensure the availability of knowledgeable teaching staff delivering the expected quality of teaching.



### Recommendation #5: Further qualification of VET teachers and trainers

- ➔ The EDU4future partnership recommends organising specific qualification courses for VET teachers and trainers to upgrade their knowledge and widen their didactic competences for the teaching of digitalisation and Industry 4.0 topics.

All partner regions agree that work-based learning (WBL) approaches in VET schools and internships at (potential) employing companies are key for raising the practical competences and skills of VET students to cope with the challenges of a digitalised working environment. For VET institutions operating in a dual VET system the work-based learning approach is easier to handle and the quality of training mainly depends on the availability of qualified teaching staff and the level of cooperation between the VET schools and the companies that implement in-house VET trainings. For partner regions with a predominantly school-oriented VET system, new equipment and infrastructure will be needed in VET schools to allow for the organisation of work-based learning modules. Alternatively, new training facilities, e.g. “teaching labs” for VET students, or internships for VET students at regional companies could be organised in a cooperation with VET schools to implement work-based learning sessions. In this case, dedicated resources and investments will be necessary to start a WBL-focussed VET approach.

### Recommendation #6: Focus on work-based learning elements

- ➔ The EDU4future partnership recommends introducing work-based learning approaches in the field of digitalisation and establishing practical teaching facilities (teaching labs) in a cooperation between VET institutions and regional target industries

### *VET students: Learners’ needs and diversity aspects*

The digital skills of young people, i.e. potential VET learners, are to be seen ambiguously. On the one hand, everyday digital applications are widely used, on the other hand, serious knowledge deficits can be observed regarding the basic functional principles of the Internet (and its security issues), etc. The initial competence level of learners entering a specific VET programme is questionable and basic trainings need to lay the ground for advanced competence development – see recommendation #1.

Besides these considerations, there are other aspects that make digitalisation and Industry 4.0 a highly relevant topic in vocational education recently. In all partner regions, VET is often disesteemed as a less preferred educational pathway compared to academic studies. In the context of Industry 4.0 and other digitalised occupational fields, it is the handling of cutting-edge technologies and mastering of a digital working environment that makes digitalisation attractive for a growing number of young people.

In times of increasing workforce scarcity, the versatility of digitalised working environments, including their technological, IT-related, social and personal aspects, provides good arguments for promoting VET programmes that prepare qualified experts for regional high-tech and lead enterprises. These assets attract a wider range of potential VET learners with different individual competence profiles than other more traditional vocational programmes. Therefore, it is crucial to implement a profound basic training in digital competences at the beginning of the VET programmes.



### Recommendation #7: Digitalisation as a vocational field for young people with diverse competence background

- ➔ The EDU4future partnership recommends promoting the versatile occupational opportunities of digitalisation as an asset to attract a wide range of young people as potential learners in VET programmes focussed on Industry 4.0 and digitalisation. Therefore, a focus on basic digital competences is a must at the beginning of the respective VET programmes.

The importance of addressing young women as a key target group for technological occupational fields is fully agreed and common sense among the EDU4future partners. Several good practice examples of supportive initiatives for young women were identified by the project partners proving the commitment of regional VET system stakeholders and labour market actors in this relation.

As mentioned before, the sector of digital work in a wider sense offers a range of benefits for young people, particularly for young women, wishing to enter this future-oriented field of work. Early access to occupational counselling is considered a key measure to activate the full potential of interested girls. For this reason, target-group oriented initiatives involving lower secondary schools, VET institutions and potential employers need to be fostered to reach out for girls and their families in the vocational decision phase.

### Recommendation #8: Dedicated awareness raising and counselling initiatives for young women

- ➔ The EDU4future partnership recommends joining force of all involved VET system stakeholders to foster awareness raising and counselling initiatives addressing the target group of young women interested in digital occupational fields and VET programmes, starting from the vocational decision phase up to targeted support when for young female specialists occupying digital working environments in the industry

### *Change processes in the VET system*

As a general observation across the partner regions, it can be stated that changes in the regional VET systems mostly occur by means of adapting already existing VET programmes rather than through the creation of new VET programmes covering new occupational profiles. In some cases, VET programmes are renewed by merging elements of different existing professional profiles (e.g. the VET programmes for mechatronics combines elements of the existing VET programmes for mechanics and electronic).

As a general long-term goal, EDU4future partners agree that changes in the VET system should lead to a smooth interlinkage between VET and school-based higher education to strengthen the compatibility of educational pathways, particularly in competence fields linked to the digitalisation of different industrial sectors.

In recent years, in most partner regions a considerable part of the existing VET programmes has been or is being updated to meet the emerging requirements of labour markets in times of digital transformation. The project partners underline the importance of establishing transparent processes for the identification of labour market needs and their translation to VET competences.



More clarity regarding the adaptation processes and stronger involvement of a wide range of relevant stakeholders and actors of the VET system involving the national and regional governance level is needed for addressing emerging labour market requirements related to technological innovation and the digital transformation demand of regional employers.

#### Recommendation #9: Transparency of change processes in VET

- ➔ The EDU4future partnership recommends establishing transparent processes for the adaptation of the VET system in response to the challenges of digital transformation and Industry 4.0, including clearly defined cooperation structures and workflows involving all relevant VET system stakeholders at the national and regional governance level

A basic difference between the EDU4future partner regions lies in the different characteristics of the VET models implemented, with predominantly school-based VET systems (e.g. in CZ and SI), dual VET systems involving VET school and practical VET trainings in employing companies (e.g. DE and AT) and mixed VET models with an increasing focus on work-based learning components (e.g. in IT and SK) – see O3 Comparative analysis. For partner regions/countries with mainly school-based VET models, the EDU4future analysis shows that the existing VET systems are recently opening towards the integration of different forms of work-based learning as an approach to equip VET learners with the competences and practical skills required in a digitalised work environment. In this context, the dual VET system as implemented in the German speaking partner countries is often considered as a good practice model.

Therefore, VET actors that nowadays are operating in mainly school-oriented VET systems can substantially benefit from a mutual exchange of experience with dual VET system experts to transfer good practice to their regional VET frameworks. Transferring the experience of work-based learning and practical cooperation with employers in the vocational training of apprentices can help speeding up the transition to an adapted VET model that addresses the actual requirements of regional economies and labour markets. At the same time, it is worth noting that the exchange of experience and inspiring practice examples among partners representing different VET systems can also be useful for stakeholders operating under the framework conditions of dual VET systems in order to tap the full improvement potential of their VET models in place.

Particularly in the preparation of young skilled workers to master digital transformation all European countries face new challenges and good practice examples how to address these aspects in VET programmes can be found in all parts of the project area as presented in the EDU4future country reports.

#### Recommendation #10: Enhanced dialogue / cooperation between VET system stakeholders

The EDU4future partnership recommends fostering the dialogue and cooperation between VET system stakeholders (educational policymakers, VET schools and other related training institutes, labour market institutions, industry representatives and regional companies) in a transnational exchange of experience for the benefit of both school-based VET models and dual VET models, particularly regarding the challenges of digital transformation and Industry 4.0, as these innovative topics cause major challenges for all VET systems across Europe.



## 2. Specific EDU4future recommendations addressing the challenges of the project partner countries

According to the transnational project methodology the focus of EDU4future research was on the improvement of the processes for the modernisation of the regional and national VET systems in the partner countries to cope with the challenges of digital transformation and Industry 4.0.

For each of the partner countries, a set of country-specific recommendations was developed in the course of the EDU4future project, reflecting the research work of project partners and further expert inputs gained through regional stakeholder involvement activities, as presented in the following sub-chapters.

### *Specific EDU4future recommendations for Austria*

Vocational Education and Training in Austria is mainly based on the so-called “dual system”. The Austrian training guarantee scheme entitles each young person to enter an apprenticeship training and guarantees a training place.

The dual vocational training takes place at two different sites in parallel: a company and a vocational school for apprentices. A major part of the apprenticeship training in the dual system is the company-based practical training. Apprentices are employed in the company under a paid apprenticeship contract and complete main parts of their training in the real environment of a manufacturing plant or a service enterprise. Apprentices are fully integrated into the world of work and get full social insurance.

Dual system apprenticeship training is applicable for youth in legally recognized apprenticeship trades. These skilled trades (presently approximately 240) are included in the list of apprenticeship trades ("Lehrberufsliste"). Hosting apprentices entails additional responsibilities for the company which are also regulated and monitored.

Instruction in the part-time vocational school is organized in various ways, i.e. in a day-release system (apprentices attend school for a minimum of one full or two half days a week), a block-release system (courses are organised for a minimum of four or eight weeks per year) or a seasonal-release system (depending on the occupational sector, classes may be held during a certain season only).

Companies which train apprentices are obliged to provide apprentices with the skills and know-how stipulated in the occupational profile; this ensures a uniform minimum standard of training. Companies which are not able to provide training which covers the whole occupational profile may avail of the possibility of complementary training within a training network. Thus, even small companies may contribute their share to apprenticeship training.<sup>2</sup>

For a detailed description of the current VET system in Austria see the AT country report.

For Austria Republic as a project partner country, the following recommendations have been developed in the course of the EDU4future project, reflecting the research work of the AT project partner within the project consortium and further expert inputs gained through regional stakeholder involvement activities:

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<sup>2</sup> [Austrian education system | BFI Wien](#), retrieved on 7.11.2022



**Recommendation AT1: To streamline VET school curricula with a focus on STEM competences and basic digital skills**

VET school curricula, on one hand, are nowadays overloaded with a wide range of specific educational topics. On the other hand, a downward trend becomes evident regarding the basic competence levels of apprentices and VET school beginners in key knowledge field, such as mathematics or language skills. Although young people seem to be proficient in the use of digital tools and applications in their private lives, there are obvious weaknesses regarding their digital competences in a professional setting.

Therefore, VET curricula should be streamlined in a close cooperation between VET schools and companies to close the gaps between the required competence levels of apprentices and VET students which is often difficult to achieve due to a lack of basic knowledge, and the practical needs of employers for qualified workers that possess profound basic competences as a basis for further in-house specialisation and future-oriented upskilling. While basic digital competences are mandatory in all occupational fields today, the peak competence requirements of different industry sectors and craft companies vary substantially. On top of a profound education in basic digital competences, a range of elective VET modules can reflect the specific requirements of different industry and craft sectors.

**Recommendation AT2: To upskill VET teachers and upgrade VET school infrastructure in the field of digitalisation and industry 4.0**

In line with the rapid development of digital technologies and their industrial applications, a targeted upskilling campaign for VET teachers is necessary to enable the teaching staff for addressing recent development of digital technologies adequately. An assessment of the qualification level of VET teachers regarding digitalisation topics and industry 4.0 should be integrated in the quality monitoring framework of the VET system. Further, the technical infrastructure of VET schools needs to be continuously improved to ensure a state-of-art level of technical teaching environment across the VET school system.

**Recommendation AT3: To establish a systematic approach for the pedagogic and didactic capacity building of the in-house VET trainers and apprenticeship managers in the enterprise sector**

Digital transformation also means that new challenges emerge in day-to-day work of the corporate VET trainers and apprenticeship managers. While this staff is highly qualified in the respective fields of technology and production management, there is a need for capacity building in the pedagogic field, particularly regarding the didactics for teaching cross-cutting digitalisation topics. It is recommended to develop systematic capacity building measures and upskilling courses for the in-house teaching staff of the companies to offer a pathway for continuous qualification and certification of industrial VET experts.

**Recommendation AT4: To enhance the promotion of new professional pathways and the related educational models based on innovative cooperation approaches between VET schools, academia, and the enterprise sector**

A variety of innovative educational models, such as apprenticeship after finalising upper secondary education, academic dual curricula in cooperation with partner companies, apprenticeship training combined with a programme for the general qualification for university entrance, etc. have been successfully demonstrated and put in action based on new cooperation approaches between the educational system and the enterprise sector.



The innovative professional pathways and carrier opportunities that become accessible for graduates from these programmes should be widely promoted to reach out for the large groups of young people that could potentially pursue their professional development by choosing one of these options. In this context, it is recommended to establish a network of coordinators for VET-based carrier options in order to raise the awareness of students in general-education secondary schools as well as secondary vocational schools for the potential of VET-based educational pathways.

### *Specific EDU4future recommendations for the Czech Republic*

The school-based VET system in the Czech Republic provides a large scope for active vocational schools at the local level. On the other hand, at the system level, it lacks the necessary VET quality management tools, such as bodies and processes. Both are necessary to ensure dialogue between all stakeholders and to strengthen the role of other labour market and vocational education actors, especially employers. The Czech Republic needs to move towards a partnership-driven VET system.

- The VET system in the Czech Republic is strongly school-oriented and the position of employers and other social partners is weak, especially at the national and regional level. At the local level, however, there are many examples of functional and effective cooperation between vocational schools and employers regarding the content of vocational training and the provision of work-based learning at company workplaces.
- The current school legislation does not address the management of the VET system with an appropriate role for social partners in modernising the structure and content of VET programmes.
- The most complex changes needed are related to the paradigm shift from a school-based VET system to a model of partners led VET system. Such changes require political will to reform VET, and their implementation is always very complex and with uncertain outcomes.
- Projects to strengthen the position of employers in the VET system and to modernise courses are one-off (usually with ESF support), which has also been criticised by the OECD. The results of such projects are often positive but fail to be used for systemic reform of VET.

For a detailed description of the current VET system in Czech Republic see the CZ country report.

For the Czech Republic as a project partner country, the following recommendations have been developed in the course of the EDU4future project, reflecting the research work of the CZ project partner within the project consortium and further expert inputs gained through regional stakeholder involvement activities:

#### **Recommendation CZ1: To lay down rules for an adequate involvement of the social partners with a stronger involvement of employers to reflect changing needs of the labour markets**

Rules should be laid down for adequate involvement of the social partners with a stronger involvement of employers. This will ensure that the current revision properly reflects the changing needs of the labour market.

It is necessary to find a solution for social partnership management of VET in the Czech Republic that will be long-term, sustainable and stable. The position of the social partners in the Czech VET environment needs to be strengthened through a properly set-up management of the VET system in the Czech Republic. The VET management system with the partnership status of the social partners needs to be resolved at the national but also at the regional level so that local labour markets' needs can be better addressed in a subsidiary way.

Therefore, the most appropriate solution seems to be to enshrine the partnership principle in law. Provisions could cover the definition of the role of the social partners in the quality management of VET, the requirement to ensure that VET programmes are in line with labour market needs, the relevant processes for VET programme revisions and the creation of new VET programmes, and the bodies for managing the system at national and regional level (e.g. in the form of Councils).

**Recommendation CZ2: To involve employers more widely and systematically in the modernisation of the VET system and its content**

Employers need to be involved more widely and systematically in the modernisation of the VET system and its content than is currently the case (individual participation in working groups). The review of programmes should take place on a regular basis, for example after a set period of time since the approval of the previous version of the relevant programme.

Employers have so far been only minimally involved in the modernisation of VET programmes on national level, mostly through individual participation in working groups, often dominated by representatives of vocational schools. This may lead to insufficient reflection of new labour market needs and is no longer sustainable given the increasingly rapid economy/labour market transformation.

Another problem in the CR is that employers and other social partners are not invited from the outset to initial discussions on strategic needs and priorities when work on major national education strategies is launched. Social partners are involved late and insufficiently in national education development strategies. The consequence is that the strategies do not sufficiently reflect the challenges of VET from a labour market perspective and address the issue almost exclusively from the perspective of the state and educators. Employers are often given the opportunity to comment on documents only after they have been elaborated in detail, with little space to prepare comments and make major revisions.

**Recommendation CZ3: To accelerate the adaptation of VET programmes in response to new technological developments and transdisciplinary competence requirements and introduce regular revisions of VET programmes**

New trends and technologies are emerging and being introduced at an ever faster pace. This brings a higher dynamics of new requirements for workers' competences. However, there is no requirement in the Czech VET system to revise VET programmes whether they still meet sectoral requirements. The absence of such a revision increases the risk that the national standards for VET programmes will become outdated. Currently, the revision of VET programmes is not systematically approached. A process should be introduced in legislation to ensure that VET programmes are in line with developments in the labour market. A possible solution is to set a maximum period of validity for an approved national standard, after which the validity of the program must be checked and, if necessary, upgraded. The recommended period is 5 years. Similarly, procedures for initiating new VET programmes and phasing out outdated programmes should be established.

The new competency requirements for workers that are emerging in the context of Industry 4.0 have one common feature. They often occur at the boundaries of traditional disciplines. The narrow division of VET programmes in the Czech Republic cannot easily respond to this demand as they are divided into many separate categories (e.g. separate mechanical engineering and separate electrical engineering). As a result of this division, it is difficult (if at all) to "construct" a standard for a programme that is multidisciplinary. A solution would be to simplify the structure of the discipline groups, which would allow for easier preparation of modularly appropriate programmes.

**Recommendation CZ4: Partnership management of VET: paradigm shift from the state as the central actor in VET management to the state as a partner in the process.**

There is significant potential for improving conditions and processes at national and regional level in the Czech Republic. The key challenge is to change the perception of the state as a central actor in the VET system into a partner in the process, on an equal footing with the social partners (especially employers and trade unions) and the regions. This partnership principle should be adequately



reflected in the relevant legislation. If this is not done, the OECD comments on the Czech VET system from 2010 will remain valid. The OECD criticises that the position of the Czech social partners in the VET system is weak and should be strengthened.

Several projects aimed at social partners' involvement have generally been funded as ESF projects. In many cases, the recommendations were not reflected in the proposed changes after the end of the projects. Therefore, the most appropriate solution seems to be to enshrine the partnership principle in law.

**Recommendation CZ5: To introduce the principle of partnership dialogue between social partners and the VET system also at the regional level (e.g. in the form of Regional VET councils)**

In the current Czech VET system, local cooperation between specific enterprises and specific vocational schools works best. At the local level, there are many examples of high-quality and long-term cooperation between vocational schools and employers.

There is ongoing communication between the two actors on new qualification needs of the company, to which the school can respond flexibly. In turn, the schools meet the needs of local employers and implement new qualification requirements in the school curricula.

Furthermore, cooperation between labour market and vocational education actors at regional level is gradually improving. This is despite the fact that there are no legislative requirements for regional cooperation in VET. The improvement of regional dialogue is linked to the development of voluntary regional initiatives, the so-called Regional Employment Pacts. Employment Pacts act as platforms to promote cooperation between institutions, businesses and other actors involved in employment, education and the labour market.

Similar to the national level, regional practices need to be introduced in school legislation (e.g. in the form of Regional VET Councils). It is important to note here that about three quarters of vocational schools are established by regional authorities. The role of regional governments in the VET system is therefore important. It is therefore essential to introduce the principle of partnership dialogue also at regional level.

### *Specific EDU4future recommendations for Germany*

The German VET system can be characterized by its “corporatist structure (which) has been a key stabilising factor because employers’ associations and trade unions generally agreed on the main organisational principles of the dual model [...]. The social partners are involved at all levels of decision-making (national, regional, sectoral and firm) and social dialogue and co-determination shape the implementation of VET reforms”.<sup>3</sup>

The basic configuration of the participants in the regulatory process (Federal Government, States, social partners) shows that VET regulations must necessarily be an expression and result of successful consensus talks, since in addition to the educational and cultural authorities from the Federal Government and the States, key organisations of the employers and the trade unions are also involved.<sup>4</sup>

For a detailed description of the current VET system in Germany see the DE country report.

For Germany as a project partner country, the following recommendations have been developed in the course of the EDU4future project, reflecting the research of the DE project partner within the project consortium and further expert inputs gained through regional stakeholder involvement activities:

#### **Recommendation DE1: To ensure that the revision of training occupations will be based on the formulation of specific objectives and time-efficient processes**

The influence of the different perspectives ensures the relevance and acceptance of a revised training occupation in professional practice, but is based on a very general formulation of objectives.<sup>5</sup>

The formulated criteria for the recognition and continuation of training occupations and their essential characteristics offer a wide scope for interpretation, which is left to the judgement of all involved participants.

According to stakeholder feedback, the various actors involved in the process of reorganising VET regulations work together effectively. However, it can be assumed that a multitude of objectives are being pursued at the same time. Differences and alignment of interest between the actors exist during, but also before, the opening of the procedure and can lead to long consultation loops and thus to delays in the process. As stated by some stakeholders, there may also be room for optimisation of the process to clarify the responsibilities of all involved actors.

#### **Recommendation DE2: To introduce a structured approach that can guarantee the successful transfer of the latest labour market requirements into the vocational school curricula**

It is also a problem that there is very little consideration for the specific mechanisms that are used to 1: establish labour market needs and 2: translate labour market needs to VET competences. These approaches seem unclear and somewhat arbitrary.

The relatively slow modernisation processes of curricula and thus of school-based training can in some cases be absorbed in company-based training, as the training companies are often already familiar

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<sup>3</sup> Haasler, SR 2020, The German system of vocational education and training: challenges of gender, academisation and the integration of low-achieving youth, *Transfer* 26(1), 57-71, P. 61, available online: [\[journals.sagepub.com/doi/full/10.1177/1024258919898115\]](https://journals.sagepub.com/doi/full/10.1177/1024258919898115)

<sup>4</sup> Deißinger, T (2020), Kaufmännische Ausbildungsberufe im Wandel - Erfahrungen mit der Neuordnung im deutschen dualen Ausbildungssystem, in: *Wirtschaftsdidaktik - den Bildungshorizont durch Berufs- und Allgemeinbildung erweitern: Festschrift für Josef Aff*, Greimel-Fuhrmann, B & Fortmüller, R (Eds). Wien: Facultas, 11-27. P. 12 (translated from the original source).

<sup>5</sup> Lohse, C (2017), Ordnungsverfahren für eine Weiterentwicklung von Ausbildungsberufen, *Lernen & Lehren* 32(4), 138-43. P. 141 (translated from the original source).



with newer equipment, work processes, etc. before these find their way into vocational school curricula. However, as this is highly dependent on the dedicated efforts of individual VET providers, this is not a structured approach that can guarantee the successful transfer of labour market requirements into VET as a whole.

With view on the labour market needs for skilled workers and the two different and practically separated systems (VET and fully school-based/higher education), a political approach for an overarching reform is currently not evident, although the overall system is not geared to the structural changes that will occur in the labour market as a result of demographic developments and the upheavals that are still to come under the heading of Industry 4.0.

**Recommendation DE3: To incorporate the perspective of VET providers, teachers and students in the development and revision of VET programmes**

VET institutions' needs (incl. student, teacher & staff, available infrastructure etc.) are only rarely considered in the VET revision processes, which may contribute to the mismatch between supply of and demand for particular VET offers.

While the attractiveness of VET is of course primarily challenged by the increasing popularity of higher education, there is also a mismatch between the VET offers available and the candidates interested in taking up VET courses. Too many candidates interested in taking up vocational training cannot find a suitable apprenticeship. At the same time, many businesses struggle to find suitable candidates. A greater consideration for their needs could help to meet the businesses' requirements by tackling the skill gaps of potential apprentices, at an early stage of their educational pathways.

In light of the limited consideration for student, teacher and VET provider needs, there seems to be less focus on the practical implementation side of VET reform. Many of the ideas and changes may be great on paper; however, in reality many VET institutions struggle to implement changes. On one hand, the infrastructural and technological requirements cannot always be met straight away and require additional resources. On the other hand, VET schools are often chronically understaffed, and staff have limited capacities to engage in meaningful training to further their skills and expand their teaching repertoire. Consequently, to ensure the envisioned change can be implemented on all levels, more practical measures also need to be in place, e.g. improving teaching conditions as well as ensuring provision of technologies and training to support Industry 4.0 ready VET offers.

**Recommendation DE4: To open room for the critical reflection of the existing processes within the German VET system and stay connected with international developments to allow for further optimization of the German VET system**

Satisfaction with the set VET system can lead to over-satisfaction and little willingness for critical reflection. Due to the status/reputation of the German VET system, there seems to be a degree of overconfidence in the processes involved, which in some cases leaves little room for critical reflection.

The resistance to learning from and interest in impulses, ideas and approaches from other countries is also problematic. Many current issues are global and rarely disconnected from the challenges other nations are facing; solutions found elsewhere should be considered more and can surely be adapted and applied to the German VET context.



### *Specific EDU4future recommendations for Italy*

In Veneto Region, as well as in Italy, the Vocational Education and Training (VET, in Italian: Istruzione e Formazione Professionale, IeFP), with EQF3, takes place mostly at school and in-company training is limited to a few months of internship. VET centres are the providers of the VET education. As for the fourth year of the IeFP, which guarantees the EQF4 qualification, the system is mainly very similar to the dual one.

There is no distinction between the different sectors since training is organized in a homogeneous way inside the region regardless of the field. However, it is important to note that out of 300 IeFP (EQF3) courses, 24 apply a dual system. Some exceptions are made in other experimental courses organized by the training centres.

For a detailed description of the current VET system in Italy see the IT country report.

For Veneto Region as a project partner country, the following recommendations have been developed in the course of the EDU4future project, reflecting the research of the IT project partner within the project consortium and further expert inputs gained through regional stakeholder involvement activities:

#### **Recommendation IT1: Deploy the full potential of VET innovation through bottom-up stakeholder networks of training centres and companies to reflect the diversity between the different territories and respond to local labour market needs**

The relationship between companies and the VET centres who have been working together for years has consolidated and has been well defined by now, forming a strong informal local cooperative network in which actors recognize each other and are motivated to follow common goals and achieve concrete results. Intensive cooperation and the integration of a wider range of regional stakeholders is indispensable for innovation and change within the VET system in line with local needs, regional and national standards.

It could be useful to organize activities that facilitate and enhance the cooperation between local actors, and therefore allow them to develop adequate skills, also for improving communication and sharing of skills; implementing systemic thinking and the logic of social forecasting to look to the future through a common approach; and learning about new opportunities for collaboration.

#### **Recommendation IT2: To recognize the role of the regional VET system and increase its visibility at the national level**

As the Italian VET system (IeFP) is regional in nature it is often not addressed in the activities that arise from the Ministry of Education and also not adequately considered by the school offices. The regional nature of the courses leaves VET excluded from national educational development initiatives in many cases. VET should be better included in the national educational development initiatives.

The value of vocational training is often not sufficiently perceived. Also, the monitoring structure is not yet well established and under discussion and, at the interinstitutional level. It is often difficult to mediate among the different actors due to the territorial nature of the VET, which from some stakeholders is considered an important plus, that guarantees the employability of people and the satisfaction of the local labour market needs while being disregarded by other stakeholders.

To improve the perception of the VET system more attention should be paid to targeted communication measures for overcoming existing negative stereotypes. Career paths based on VET qualification should be promoted in a more effective way.



### **Recommendation IT3: To establish an adequate monitoring model for VET programmes**

In the review of the Repertoire<sup>6</sup>, (the Italian guideline for qualifications and VET standards) the skills and qualifications were implemented in 2019. Their implementation was well received by the VETs, but the results of this change will only be seen at the end of the 2021/2022 school year.

Currently, the monitoring model, the roles, and responsibilities of the various actors involved are being discussed. This aspect requires a lot of time and negotiation between the various and numerous actors involved. A suitable monitoring approach for VET courses should be agreed in due time to ensure continued quality assessment and improvement of VET.

Additionally, it could be effective to maintain contact with former VET students to better understand the difficulties they have found in the world of work or in their education once their training path is complete and introduce their feedback in the future monitoring model.

### **Recommendation IT4: To raise the awareness of regional companies about the role of training center in covering the regional labour market demand**

Companies are realising that the staff is increasingly inadequate and that their role in training is essential to overcome this situation. They often need trainees and therefore workers trained by VET centres. However, as long as the labour market is still functioning the ambition of some companies to collaborate is still low. This creates a comfort zone that slows down the change. Some companies still do not adequately consider the importance of VET centres and lack awareness and knowledge about the training centres and related cooperation potential. Therefore, measures should be taken to extend the functional cooperation between enterprises and VET vocational schools.

### **Recommendation IT5: To train and upskill employment consultants to support the promotion of VET carrier options and VET centre programmes**

Trade associations could contribute to training in this sense by organizing training events for employment consultants. A pool of trained employment consultants could efficiently support the promotion of VET pathways addressing both regional companies and potential VET students.

### **Recommendation IT6: To strengthen the exchange of good practices among VET centres**

Even though VET centres develop and deliver innovative good practices, they are rarely documented and shared due to the lack of time and capacity within the centre. The analysis would help highlight both the strengths and benefits of the experiences and the solutions adopted to face the challenges and overcome the weaknesses. Associations, together with the Veneto Region, could give support to the centres and facilitate the sharing of information among companies and other centres in the Region. The exchange of these good practices (and possibly also some “bad experiences”) would facilitate and speed up the innovation process.

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<sup>6</sup> Repertorio Atti n. 155/CSR del 1° agosto 2019

### *Specific EDU4future recommendations for Slovakia*

In Slovakia, a reformation process of the VET system started about six years ago and is still ongoing in line with the established national strategies. At the moment, the dual VET system is evolving besides the prevailing school system. The VET system needs to undergo a profound reformation to face potential changes in the future direction of the Slovak economy - which is currently dominated by a focus on the automotive industry - to a wider range of Industry 4.0 applications.

- In Slovakia, the law framework for VET formalizes and establishes an institutional frame for the cooperation of VET providers, employers, regional government, and the national authorities.
- Companies are actively cooperating with VET providers in the process of adaptation of existing and creation of new education programs.
- However, the flexibility offered by the regulatory framework for the adaptation of the educational programmes of VET schools is not sufficiently used so far.

For a detailed description of the current VET system in Slovakia see the SK country report.

For Slovakia as a project partner country, the following recommendations have been developed in the course of the EDU4future project, reflecting the research of the SK project partner within the project consortium and further expert inputs gained through regional stakeholder involvement activities:

#### **Recommendation SK1: To optimize the secondary school network, the composition of educational departments and the number of classes based on labour market needs**

Currently, available products and information, such as labour market forecasts and employment office statistics on vacant jobs, are used inefficiently to manage / coordinate the numbers and directions of pupils in schools. This causes a delayed response to supply and demand for graduates in specific labour market sectors. Foresight visions and employer forecasts in relation to the expected qualifications of workforces should be shared and considered in the VET reformation processes.

This would be an important step towards the abolishing unpromising fields of study and supporting existing, practice-confirmed fields of study, or creating new, necessary fields of study, based on the actual demand on the labour market in order to solve the acute problems of companies in finding adequate employees.

#### **Recommendation SK2: To strengthen the integration of content related to Industry 4.0 in VET programmes and further develop the dual VET system in this direction**

While the modernization of VET programs has taken place, just a few specific processes have been established to regulate or implement the competences needed for Industry 4.0 in vocational education and training in Slovakia.

Secondary vocational schools make insufficient use of the legal possibilities to adjust their school curriculum to improve the employability of students (flexibility of adjustment can be up to 30%). The individualisation of training contents and setting of educational subjects in connection with practice should be increased. In this context, the dual VET system is highly relevant as companies provide a technological basis and culture for tailor-made study programmes in occupational fields related to Industry 4.0 applications.

The legal framework on VET includes an option for establishing of Centers of Excellence operated by VET providers, so called Centers of VET. Launching of such Center of Excellence is also formalized. This could be an option suitable for setting up VET Centers which will adequately focus also on Industry 4.0.

**Recommendation SK3: To evaluate/monitor the real applicability of VET programmes and improve the career guidance to VET students and VET graduates**

The current system of financing VET schools in the Slovak republic is based on the number of students which creates a competitive environment between different types of secondary schools and leads to insufficient consideration of the individual preconditions of a student for a given study programme.

In order to assess the quality of education and the efficiency of career guidance, it would be most appropriate to interconnect the information systems of the state (employment office, social insurance, Ministry of Education) and analyze the applicability of high school and university graduates in their field. At the same time, the system of profiling of young people in career counselling should be improved. For this purpose, the knowledge of career counsellors about educational paths and up-to-date professional competence requirements, particularly in the field of Industry 4.0, needs to be increased.

**Recommendation SK4: Support students' competences in STEM fields and their interest in STEM oriented studies**

In Slovakia, new measures are set in the national strategies, focused on digital and STEM skills. With regard to Industry 4.0, it is a problem that the overall digital competences are insufficient. Secondary school programmes need to be strengthened with computer science and informatics content in response to the digital transformation going on in regional enterprises. Although VET schools can adapt their school curricula up to 30 % of the national standard to meet local needs, little use is made of this option.

Particularly, measures should be intensified to support the interest of girls (but not only girls) in mathematics and technical subjects in order to increase their interest in studying in technical and IT fields).

More attention should also be paid to further training of teachers in technical sciences – such as mathematics, informatics, chemistry and physics – as these teachers have a major influence on students' decision for technological study paths.

**Recommendation SK5: To ensure a balanced multi-institutional communication and cooperation of VET stakeholders as a basis for further improvement of VET**

There is a lot of untapped potential in the multi-institutional communication on an informal basis, e.g., in brainstorming groups, formulating common vision and roadmap for VET, identification of joint projects, etc. Establishing regional thematic groups with an advisory voice could lead to a better regional dialogue between schools and companies.

On the other hand, it is important to keep the balance between large companies with a dual training system and VET schools to avoid a situation in which the company will enforce "education tailored to its own needs" which may be narrow the professional profile of the students and reduce their employability in a different professional context.

A certain complication can also arise from the difference of opinion of sectoral groups about the priorities of VET programs. Therefore, an effective cooperation/dialog between all involved actors is needed to ensure the transparency of processes and decisions on the regional level.



### *Specific EDU4future recommendations for Slovenia*

After compulsory nine-year primary education, students continue their education in secondary education programs. The differentiation of children begins in high school, usually at the age of 15. Students choose between general and vocational programs. Secondary education is divided into 1) general education, which includes various types of gymnasiums and a Matura course and is intended to prepare for continuing education at universities, and 2) vocational and professional education is intended to acquire a profession for entering the labour market and professional education for continuing education in tertiary education programs.

The management of vocational and technical education is centralized. Decisions on the establishment of vocational and technical schools or the distribution of vocational and technical education programs among schools are taken at a national level. The Slovenian secondary vocational and professional education is mostly school-based and differs substantially between sectors and occupations. Practical classes are mostly organised as in-school workshops. Following the Vocational Education and Training Act (2006, amended in 2017 and 2019) and the Higher Vocational Education Act (2004, amended and amended in 2013), schools implement initial vocational and professional education programs in cooperation with companies.

Additional qualifications are acquired in further and supplementary training on the labour market (related to the supplementation of skills and competencies) and are not regulated at the national level; are intensely focused on the labour market and are awarded by the employer, a group of employers or the Employment Service of Slovenia.

For a detailed description of the current VET system in Italy see the SI country report.

For Slovenia as a project partner country, the following recommendations have been developed in the course of the EDU4future project, reflecting the research of the SI project partner within the project consortium and further expert inputs gained through regional stakeholder involvement activities:

#### **Recommendation SI1: Strengthen the knowledge transfer between VET schools and companies**

Despite the set goals, there are not enough activities and incentives to implement the activities. Occasionally there is a lack of understanding of school or company management who are unwilling to invest in knowledge transfers and new IT skills. There is a lack of initiative in schools to involve companies, and on the other hand, companies do not even have enough staff to connect with schools. It is recommended to introduce incentives to intensify the cooperation between schools and companies and implement measures for further improvement of the shared vision of vocational and technical education among stakeholders.

#### **Recommendation SI2: To set a focus on digital skills in vocational educational programmes, introduce IT and industry 4.0 content to the VET curricula and to build up the capacities of teachers in these fields**

In 2019, basic digital skills in the 16-74 age group were slightly below the EU average (58%) at 55%. The EU is working to increase this level for the 16-74 age group to 70% by 2025 and 80% by 2030. Slovenia will thus have to step up investment and focus its development on strengthening digital skills (European Commission, 2020a). Slovenia has updated the national development strategy Digital Slovenia 2020, i.e. an overarching strategy covering fundamental strategic shifts and adopting an action plan for digital education by 2027.

Also, companies would be more interested to get involved in cooperation with schools, if digital skills development, IT and industry 4.0 content were added to the curricula by the Ministry.



There should also be more trainings for teachers in these areas, more frequent checking of how teachers use what they have learned in their work, involvement of state institutions in support teachers and the organisation of cooperation and projects, between secondary schools and institutions and companies.

**Recommendation SI3: To improve the quality of on-the-job practical trainings and extend the newly established apprenticeship programs**

The quality of on-the-job practical training and competence-based assessment remains a challenge. Significant efforts have been made by investing in new training facilities (inter-enterprise training centres) and strengthening practical training by working in companies.

With the new Apprenticeship Act in 2017, the implementation of apprenticeships in three-year vocational education programs (ISCED 353) began. The social partners are discussing extending apprenticeships to other levels of education, to adults and the service sectors.

**Recommendation SI4: To set a focus on adult education / upskilling and further strengthen adult education guidance centres to meet future labour market demand**

Technological change will require a more skilled workforce, which will require a greater focus on adult education and training of the workforce. As a result, the demand for raising adults' knowledge and skills is increasing.

Guidelines for the implementation of counselling activities were adopted in 2020 based on the revision of the Adult Education Act (2018), which encourages counselling for adult participants in the educational process. The support by adult education guidance centres and other public education organizations providing free guidance and counselling for less educated groups of adults should be continued and widened to increase the involvement of different adult target groups in lifelong learning.

With a significant reduction in adult participation in lifelong learning over the last decade (8.4% in 2020), Slovenia must continue its efforts to achieve the national target of 19% adult participation in education by 2030; Opportunities for continuous improvement and retraining of the elderly are necessary to ensure the availability of digitally skilled workers on the labour market.



## Annex I: Methodic approach for the development of the EDU4future Recommendations

For the development of the Recommendations the following project results were utilised:

- Country reports prepared by the project partners as a part of Output #2 (using the jointly developed transnational methodology, Output #1)
- Comparative analysis of country reports, Output #3

Going beyond the already achieved project results, the task leader introduced an additional external source of information to contrast the findings and results of IO2 and IO3 of the EDU4future project with the conclusions of other stakeholder groups with a similar thematic focus in order to enrich the discussion of the EDU4future partners at this final stage of analysis.

As a useful source of information for this purpose, the task leader identified the work group report on “qualification and competences for Industry 4.0” published by the Austrian platform Industry 4.0<sup>7</sup> in 2018. This report (further “I4.0 platform report”) was introduced as an inspiration for revisiting the partnership’s own research results for several reasons. First, as the Austrian work group involved a wide range of I4.0 platform stakeholders operating in different VET system positions, the respective report depicts a multi-stakeholder perspective which to a certain extent resembles the project approach of the EDU4future partner consortium. Secondly, the report provides a comprehensive and systemic view on a wide scope of relevant stages of initial and further education going even beyond the scope of research defined by the EDU4future project. Therefore, it provided a “big picture” which was used by EDU4future partners for reframing the specific VET system aspects addressed by the EDU4future project as elements within a comprehensive VET system outline.

ConPlusUltra as the task leader for the preparation of the EDU4future Recommendations report extracted from the I4.0 platform report a list of topics of general relevance for the discussion of the integration of Industry 4.0 aspects at the secondary school level and in the dual VET system. This list was shared with the EDU4future project partners who were asked to prepare a ranking of the proposed items regarding their relevance within the framework conditions of their own VET systems. This approach allowed for interlinking the already prepared EDU4future research results with the thematic structure of the I4.0 platform report. The feedback received from all EDU4future partners resulted to the following aggregated top ranking of the thematic issues in question (still keeping the wording of the I4.0 platform report):

- *Adaptation of teaching programmes to integrate digital basic competences*
- *Implementation of cross-topic and practice-oriented STEM teaching*
- *Education in key cross-cutting competences, i.e. communication, cooperation, and creativity*
- *Promotion of positive role models / equal opportunities*
- *Stronger focus on digital competences in the training and upskilling of teachers*
- *Improving the digital infrastructure in VET schools and the framework conditions for teachers for integrating digital teaching and learning methods*
- *Evaluation of VET regulations for adapting / upgrading technology standards on a regular basis*
- *Strengthening of educational counselling and professional orientation programmes, particularly for young women*

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<sup>7</sup> [WEB Industrie4.0 Ergebnispapier 2018.pdf \(plattformindustrie40.at\)](#), retrieved on May 30, 2022



In a consecutive elaboration step, the top ranked issues were linked back to the conclusions section of the EDU4future Comparative analysis (IO3, chapter 4 conclusions, tables #19 - 22). The tables of chapter 4 of the Comparative analysis include more than 70 suggestions for the improvement of different aspects of the VET systems from all project partner countries. The cross-checking exercise of linking these suggestions that had been developed by the EDU4future partnership in former steps of project implementation allowed for developing and validating the thematic structure of the EDU4future recommendations as presented in chapter 1 and 2. On this basis, the following thematic clusters were defined as a guiding structure for the EDU4future Recommendations:

- VET schools: Teaching staff, teaching approaches and infrastructure
- VET students: Learners' needs and diversity aspects
- Change processes in the VET system

For each of the thematic clusters, chapter 1 of the EDU4future Recommendations report presents a set of generalised recommendations which were transnationally discussed and agreed at EDU4future partnership level as being relevant and useful for all of the partner countries to introduce changes in the VET system in response to the challenges of Industry 4.0 and digital transformation of the economy.

Chapter 2 addresses the specific challenges of each partner region based on the findings of the respective country reports (IO2) and the results of the comparative analysis (IO3). On this basis, several specific recommendations are presented for each partner country to reflect the concrete challenges that need to be addressed to meet the labour market demand for skilled workers prepared for a digital and Industry 4.0 working environment under the given framework conditions of predominantly school-based or dual VET models.



## Annex II: Glossary

**Augmented Reality (AR):** System able to superimpose some additional elements on the visual reality (attributes, explanations, schemes, internal elements not visible). It can be managed in the simplest way using the smartphone/tablet camera, but usually it requires the use of special glasses. Since this is a technique based on user experience, the quality of devices and software are essential for the diffusion of technology. (Source: [t2i Glossary](#))

**Competence:** Ability to apply learning outcomes adequately in a defined context (education, work, personal or professional development).

or

Ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development. (Source: [Cedefop Terminology of European Education and Training Policy](#))

**Country Report:** Document that collects key data and country-specific information based on a common methodology. These can then be compared and evaluated to describe how labour market requirements are translated to VET in a given country.

**Industry 4.0** refers to the fourth industrial revolution; the first industrial revolution was the arrival of the steam engine in the 1700s, the second industrial revolution was the invention of electricity and Fordism (which enabled mass production), the third was the appearance of media and computers. This most recent industrial revolution describes the current phase of transformation of industrial processes, with a strong digitization of production processes and services, the introduction of interconnected sensors, the internet of things, intelligent machines (robots), artificial vision and autonomous driving systems together with new additive manufacturing technologies, augmented reality and virtual reality. This fourth revolution is called “4.0” following the revision-numbering model used in the software to emphasize its digital nature. (Source: [t2i Glossary](#))

**Internet Of Things (IoT):** Literally “internet of things” refers to the connection to the internet of devices other than computers, tablets, smartphones, smart TVs such as: appliances, light bulbs, thermostats, sensors, cameras, air conditioners, cars, street lamps, or any electronic device. In this way the device will be accessible from the network and can communicate autonomously with other devices. To have IoT, a “thing” connected to the internet should have: (a) an IP address, (b) a processor capable of handling communications. The term has a certain overlap with the concept of M2M, which, however, is understood as a set of intermediate level industrial protocols, as is the case with smart meters for example. (Source: [t2i Glossary](#))

**The Industrial IoT (IIoT):** is a subclass of the IoT that focuses on the particular needs of industrial applications such as manufacturing, the oil sector, utilities. Although they share the same technologies (sensors, cloud, connectivity, analytics), industrial applications have demanding requirements that can be summarized in the following ten criteria: security, interoperability, scalability, precision and accuracy, programmability, low latency, reliability, resilience, automation, maintenance. (Source: [t2i Glossary](#))

**Knowledge:** Outcome of assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices related to a field of study or work. (Source: [Cedefop Terminology of European Education and Training Policy](#))



**Robot:** Mechanical systems endowed with manipulative abilities (mechanical arms, systems for taking objects) and in some cases with walking ability (wheels or mechanical limbs for movement). The most advanced robotic technologies are equipped with artificial vision systems capable of recognizing objects and possibly taking/manipulating them autonomously according to non-predefined patterns. There are wide differences in models: humanoid robots (such as the famous Japanese Pepper robot, IIT's Italian R1 or social robots), domestic robots (such as the vacuum cleaner robot), drones, logistics robots (such as Amazon's Kivas and similar wheeled cargo robots that now frequent hospitals), robot animals, robot exoskeletons and limbs, combat megabots four meters high, industrial robots (collaborative robots). (Source: [t2i Glossary](#))

**Skills:** Ability to apply knowledge and use know-how to complete tasks and solve problems. (Source: [Cedefop Terminology of European Education and Training Policy](#))

**Stakeholder:** Person or organization that has an interest in, can influence, be influenced by, or perceive itself as influenced by a decision or activity. Examples: customers, owners, people of an organization, suppliers, bankers, legislative authorities, trade unions, partners or communities that may include competitors or opposing pressure groups. (Source: [t2i Glossary](#))

**Vocational Education and Training (VET):** Education and training which aims to equip people with knowledge, know-how, skills and/or competences required in particular occupations or more broadly on the labour market. (Source: [Cedefop Terminology of European Education and Training Policy](#))

**Virtual Reality (VR):** Highly immersive visual simulation of artificially generated environments and scenarios through screens or special wraparound glasses. In the most advanced versions, in addition to sounds, it can include tactile sensations and mechanical feedback thanks to special interactive ergonomic devices. Unlike augmented reality which adds synthetic elements to real ones, in virtual reality the stimuli of the real world are completely replaced by artificial ones. (Source: [t2i Glossary](#))