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VOCATIONAL EDUCATION AND TRAINING FOR THE FUTURE OF WORK

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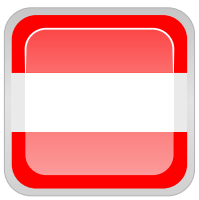

CEDEFOP REFERNET THEMATIC PERSPECTIVES

Vocational education and training for the future of work: Austria

Policy strategies and initiatives to prepare vocational education and training (VET) systems for digitalisation and future of work technologies

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CHAPTER 1.

Introduction – Impact of digitalisation in Austria

Digitalisation has become a catchword in recent years; it describes current and expected processes of structural change on the labour market. Digitalisation is seen in literature as a megatrend that is highly dynamic on a global level and is affecting all aspects of life ([1]) (Haberfellner and Sturm, 2016). In this discourse, the term digitalisation is used to embrace all trends that are related to technological innovations that have the potential to change all aspects of life in a fundamental way, like artificial intelligence (AI), automation, robotics, the internet of things, the smart home, the processing of big data, cloud computing and so on.

In academic literature, major questions can be identified which focus on the consequences of digitalisation on the labour market: (a) ongoing changes in the occupational structure; (b) future skills needs and (c) consequences for education and labour market policy (Fink et al., 2017). In general, it can be stated that academic literature is heavily influenced by the academic discourse on Industry 4.0 as originated in Germany.

Empirical research shows a positive correlation between digitalisation and regional increases in employment on the Austrian labour market (Peneder et al., 2016). Nevertheless, the results indicate that there is also a shift in the set of core tasks within occupations. This means that non-routine tasks (such as analytical, interactive tasks) have become more important in the overall set of tasks related to an occupation while routine tasks are replaced by technology (Hölzl, 2019). For Austria, it cannot be expected that there will be a trend towards a strong polarisation of the occupational structure (as postulated in international literature e.g. Goos et al., 2009) in the labour market because of the distinctiveness of the Austrian VET system in supplying a skilled workforce (Peneder et al., 2016). Another empirical analysis based on the OECD Programme for the international assessment of adult competencies (PIAAC) data has shown an automation risk between 40% and 65% for the major share of the employed workforce in Austria. 9% of the employed workforce have a very high risk of automation (>70%). The risk is higher for occupations with low qualification requirements (Nagl at al., 2017).

([1]) It needs to be emphasised that there are other megatrends that lead to a structural change of the labour market like climate change, urbanisation, globalisation and so on (Haberfellner and Sturm, 2016).

According to the current Digital Economy and Society Index (DESI), Austria is ranked in the middle of EU member countries in terms of digitalisation and in the top third of the human capital sub-index. The index also reflects a critical trend: Whereas the employment of ICT skilled workers has increased, the number of ICT graduates has declined, indicating a shortage of skilled workers on the Austrian labour market (European Commission, 2019).

These empirical results lead us directly to the question which future skills are needed by the labour market in the context of increasing digitalisation. There is consensus in the Austrian literature that skills demands will increase on the vertical (more complex tasks) as well as on the horizontal level (expansion in demanded skills sets). Domain-specific skills will still form a fundamental part of a qualification but will be enriched by IT (information technology) competences, which are needed to cope with more complex tasks at the workplace. But it needs to be emphasised that transversal competences are also becoming more important, such as digital literacy, complex problem-solving competences, social skills (e.g. teamwork, intercultural competences, creativity), self-competences (e.g. taking over responsibility, readiness for innovation) (Schmid et al., 2016; Fink et al., 2017; Moser et al., 2017).

The results of the New Digital Skills project of Public Employment Service Austria (AMS) support these findings. In workshops and interviews, representatives from around 125 leading companies from various sectors confirm that, in addition to IT competences, in particular social, methodological and other transversal skills are becoming more and more important for companies and are the key to the employability of employees. However, they also confirm that these competences must be based on a broad foundation of occupation-specific knowledge (Bliem et al., 2019).

Although digitalisation is a cross-sectional issue for education at all levels, it is specifically an important challenge for the VET system as digitalisation processes change the skill needs of the labour market: **Industry 4.0 needs VET 4.0**. Central demands for VET 4.0 are: (a) to strengthen social and interdisciplinary competences (e.g. problem-solving, teamwork) in VET; (b) to design VET programmes with combinations of different qualifications (e.g. digital business, media design, mechatronics); (c) to increase the level of VET qualification attainments; (d) to provide high-quality offers for the initial training of the skilled workforce with a high share of work-based learning (e.g. dual apprenticeship, school-based VET) and (e) to implement innovations of the dual apprenticeship training system to meet the skill demands of digitalisation. It will be important to provide both VET programmes leading to concrete IT-occupations but also to use IT as content and tool in other occupational profiles (Schrack, 2018).

CHAPTER 2.

VET policy strategies to adapt to digitalisation

2.1. Digital strategy

There is broad agreement in Austria that the general education and VET systems have to address the changing skills requirements triggered by digital innovations. The social partners, for instance, are committed to managing digital transformation in the employment and VET system (Beirat für Wirtschafts- und Sozialfragen, 2017). But how the reactions and measures should be designed is a difficult question to answer. It is mainly a matter of dedicated policy measures and their implementation in the fields of education and training as well as the labour market. Political actions might address the basic structure of education systems (e.g. to enhance social permeability), define minimum standards for IT infrastructure at the places of learning and IT competences, adapt curricula, provide basic digital literacy, enhance e-learning methods, provide further education and training for trainers and teachers and so on (Fink et al., 2017).

2.1.1. Coordination under the umbrella of Digital Austria

A first milestone was set in 2017 with the *Digital Roadmap* ([2]) strategy. The successor government has incorporated essential parts of this strategy into its government programme. In this process, the Federal Ministry for Digital and Economic Affairs (BMDW) founded the Digitalisation Agency (*DIA)* to coordinate all measures. The DIA aims to act as a coordinating contact point for digital transformation in business, society and administration. The DIA also supports the *Digital Austria* ([3]) initiative, which aims to develop Austria into a leading digital nation. The initiative focuses less on strategic aspects, but rather acts as a hub of information on various projects, it networks stakeholders and sets priorities for the future. Digitalisation is seen as a cross-cutting theme which permeates many different areas.

([2]) https://www.digitalroadmap.gv.at/ [accessed 16.12.2019]

([3]) https://www.digitalaustria.gv.at/ [accessed 16.12.2019]

2.1.2. DigComp 2.2 AT

In 2019, the BMDW published the Digital Competence Model for Austria ('*DigComp 2.2 AT*') ([4]). The tool is intended for supporting the assessment and description of personal digital competencies and the identification of possibilities for further development. It is based on the "DigComp" reference framework of the European Commission.

With DigComp 2.2 AT, the link between VET and the teaching of IT and media skills is further developed, for instance through the (demanded) enhancement of programming skills or the designing of a digital identity. Against this background, digital literacy aims to combine education and training for all citizens. In DigComp 2.2 AT, the field of digital competences is divided into six areas and described through 25 individual competences. The respective competence levels can be represented by a total of eight development stages (BMDW, 2018).

2.2. Master plan digitalisation

The Federal Ministry of Education, Science and Research (BMBWF) presented a *master plan digitalisation* for the whole formal education system, in which school-based VET at the upper secondary level forms an integral part of the system as well as higher (vocational) education and training at the tertiary level.

This master plan aims at a comprehensive strategy in the field of education and comprises three areas of action to enhance digitalisation in education and training:

(a) adaptation of learning outcomes to be achieved by learners: the action intends to revise all curricula taking into account the development of digital competences as learning outcomes in all types of schools. Another aspect is the development and use of digital learning materials;

(b) (further) education and training of pedagogical staff and development of curricula for their education and training;

(c) modernising IT infrastructure and school administration: it is envisaged to implement a uniform standard of IT equipment and availability of mobile devices in schools. State-of-the-art infrastructure is the prerequisite for digital tools to be used in schools. The school administration should enhance the use of modern IT applications to simplify school organisation and provide school services.

([4]) https://www.bmdw.gv.at/DigitalisierungundEGovernment/DigitalisierungBuergerinnenUndBuerger/Documents/DigComp_2.2_AT_barrierefrei_V14.pdf [accessed 16.12.2019]

The main objectives of the masterplan are to use digital innovations for the implementation of modern methodological and didactic standards, foster interest in technology, develop digital literacy and competences as well as critical awareness when using new technologies, develop digital competences in accordance with the skills needs on the labour market and enhance the creative potential of young people.

2.3. Austrian Social Partner Platform Industry 4.0

Another important platform for policy action is the non-profit organisation *Verein Industrie 4.0 Österreich* ([5]), which was founded by major stakeholders and policy makers in 2015 (e.g. Ministry for transport, innovation and technology, the Chamber of Labour, trade unions, the economic chambers) and now has over 40 members. Its main goal is to foster collaboration among all stakeholders and facilitate the implementation of digital transformation in Austria. One central concern is to stimulate innovation in the VET system to tackle digital skills needs.

The platform 'Industry 4.0' presents the ideas in its paper 'Qualification and Competences in Industry 4.0' in six fields of action for initial VET (Verein Industrie 4.0 Österreich, 2017): (a) learning content: adaptation of apprenticeship programmes and curricula (school-based VET, multi-skilled VET programmes); (b) plurality of learning spaces: to integrate digital learning methods, use digital tools and foster explorative and cooperative learning arrangements in conventional environments, integrate massive open online courses (MOOCS) and small open online courses (smOOC); (c) access to VET: to foster explorative learning methods, considering the needs of young people; (d) optimisation of learning conditions: to improve the IT infrastructure, focus more on transversal competences; (e) strengthening of cooperation between all stakeholders and (f) abolition of traditional gender roles: to communicate positive role models, strengthen educational counselling for young women.

2.4. Further strategies

Furthermore, the economic chambers have developed sector-specific strategies to deal with digitalisation (e.g. tourism; information and consulting). In the sector of tourism, for instance, a digital strategy has been developed in which actions for the area of vocational education and the labour market are a key element, including:

([5]) https://plattformindustrie40.at [accessed 16.12.2019]

(a) the development of digital competences in apprenticeship training; (b) development of an electronic training tool for the documentation of learning processes; (c) enhancement of digital services for trainers and apprentices and (d) training of trainers with a focus on *digital fitness* (WKO - Tourismus, Freizeit, 2017).

CHAPTER 3.

VET 4.0 initiatives and programmes

There is broad consensus that VET 4.0 has to rely on basic digital skills which should be developed at the primary and the lower secondary level (Schrack, 2018). For this purpose, the implementation of digital skills (*Digitale Grundbildung*) ([6]) has been launched as a pilot project in the school year 2017/18 and has been implemented comprehensively as a subject in curricula at the lower secondary level since the school year 2018/19. The goal is for pupils to acquire competences related to digitalisation, information, data and media competence, operating systems, etc. In the VET system, a varied mix of different initiatives can be found.

3.1. Strengthening IT-based training

In general, it is acknowledged by the economy that the new generation of curricula, which were developed between 2011 and 2016, already comply with the demands of Industry 4.0 (Schrack, 2018). These competence-based curricula already put strong emphasis on transversal competences. IT-based training programmes have quite a long tradition in the school-based VET system for some specialisations, e.g. technical informatics, electronics, communication technology, informatics. In this context, the ongoing adaptation of school-based VET curricula to digitalisation already forms an integral part of the system. For example, the curriculum for the main subject Informatics for colleges for higher vocational education was revised in the years 1998, 2011 and 2015.

Nevertheless, it is planned to expand the capacity of training programmes for IT-related occupational profiles in school-based VET. Selected VET school centres should be transformed into IT-based VET school centres, at least one centre per province. The core of IT-based VET programmes should revolve around programming, analysis and development. It goes without saying that the implementation of VET 4.0 depends on funding.

Furthermore it is expected that the links between colleges for higher vocational education and study programmes of the universities of applied sciences will be improved. In this context, additional study capacities for IT-based programmes may be provided.

([6]) https://www.bmbwf.gv.at/Themen/schule/zrp/dibi/dgb.html; https://eeducation.at/ [accessed 16.12.2019]

In addition, further education and training options for teachers and trainers in school-based VET will be strengthened. To this end, a series of events for teachers has been established in recent years which deal in depth with VET and Industry 4.0 ([7]). The goal is to achieve a common understanding of the requirements of Industry 4.0 and, as a result, of VET 4.0, and to develop projects on this basis.

3.2. Modernising apprenticeship training

The current policy in the apprenticeship training system puts strong emphasis on modernising apprenticeship programmes and/or introducing new apprenticeship programmes to meet the requirements of digitalisation. The main goal is to implement digital competences as transversal requirements and promote the application of digital media and resources in apprenticeship training. In the years 2018 and 2019, overall 17 new apprenticeship programmes were introduced and 19 existing apprenticeship programmes were modernised. New occupational profiles include construction engineering assistance, e-commerce merchant, glass process engineering, media expert, application development coding and information technology ([8]).

This modernisation of existing apprenticeships and the development of new ones are closely linked to the “Apprenticeship programmes screening” project (cf. Chapter 4.3). This current project aims to screen all apprenticeship programmes systematically (in total about 200) to ensure the training contents are up-to-date regarding aspects of digitalisation (Dornmayr et al., forthcoming). Again, the ongoing revision of training curricula – although not very transparent – forms a traditional part of the apprenticeship training system (Mayerl and Schlögl, 2015). In this context, successful attempts have been made to develop competence-based training regulations which put greater emphasis on transversal competences that are important for dealing with digitalisation. The introduction of a standardised “digitalisation module” in apprenticeship training has been discussed time and again, but has not yet been implemented (Schmölz et al., 2018, for example, have created a related model).

([7]) Most recently, for example, at the University College of Teacher Education in Salzburg in April 2019: https: //www.mint-salzburg.at/wp-content/uploads/2019/03/MINT-Industrie-4.0-Fachtagung.pdf [accessed 16.12.2019]

([8]) https://www.bmdw.gv.at/Themen/Lehre-und-Berufsausbildung/Lehrlingsausbildung-Duales-System/LehrberufeInOesterreich/Lehrberufspaket-2019.html [accessed 16.12.2019]

Another incentive to make digitalisation in apprenticeships more visible is the special award established in the *fit for future* 2017 ([9]) programme. It aims to distinguish training companies with special commitment to using digital technologies for the company-based part of apprenticeship training. The key evaluation criteria were, for example, the technical and creative implementation of one or more online tools, benefits for users, experience reports/feedback from apprentices and IVET trainers. The winner was awarded the state prize “Best training enterprises” and the companies were presented with their approaches in a separate brochure. Since then, further examples of digital learning and training in enterprise VET have been regularly collected and published on the website https://ausbilder.at in order to make these available to other training companies and IVET trainers as good practice.

The Austrian economic chamber (WKO) ([10]) in cooperation with the BMDW has also launched a project call with a focus on *using digital learning technologies in apprenticeship training* and *promoting the development of digital literacy*. The submission deadline was February 2018 (Dornmayr and Löffler, 2018). The funding volume was up to 200 000 Euros for each project. This initiative addressed organisations with experience and knowledge relating to apprenticeship training. The above-mentioned website https://ausbilder.at is a result of this project call.

([9]) https://staatspreis-fitforfuture.submit.to [accessed 16.12.2019]

([10]) https://news.wko.at/news/oesterreich/digitalisierung-lehre-projektaufruf.pdf [accessed 16.12.2019]

CHAPTER 4.

Using 4.0 intelligence for VET

4.1. AMS New Digital Skills

Public Employment Service Austria (AMS) [Arbeitsmarktservice] set up a Standing committee on new skills in 2009 whose main aim is to (a) gather information on future qualifications in specific domains and (b) give recommendations for designing innovative approaches to qualification processes.

Within this framework, 'new skills interviews' with experts and stakeholders have been published to give insights into the facets of a rapidly changing education system and work environment, with specific focus on key terms such as Industry 4.0 and digitalisation. The research reports, module catalogues, interviews and documentation of events are freely accessible via an AMS database ([11]). Recently, another output of AMS is a folder aiming to support young people in vocational career guidance and counselling with special emphasis on the use of new technologies (Bliem et al., forthcoming).

In the sub-project "New Digital Skills", a multi-method research approach (workshops, interviews, research) has been applied since 2019 jointly with company experts to compile specific developments and changes in the demands placed on employees and jobseekers and in the need for IVET and continuing education and training (CET) due to increasing digitalisation.

The results of the project will subsequently be incorporated as modules into concrete CET programmes for jobseekers. In addition, all results are made available to the stakeholders of the education system in order to enable them to examine the curriculum contents of all levels of education as well as the training regulations in apprenticeship training for possible adaptation requirements. The results are also made available to companies to enable them to reflect on their in-house training activities (Bliem et al., 2019) ([12]).

4.2. Use of big data

4.0 skills intelligence, like big data and artificial intelligence (AI) analytics, is not yet used broadly when designing VET programmes in Austria. Nevertheless, there are a few research papers which use big data for understanding the skills needs of the

([11]) https://www.ams.at/newskills [accessed 16.12.2019]

([12]) https://newdigitalskills.at [accessed 16.12.2019]

labour market and/or analysing curricula referring to the requirements of digitalisation.

A recently published research paper analysed job advertisements (in total about 170 000) of the public employment service in the first half of 2017 (Schober and Füllsack, 2018). The goal of the research paper was to analyse the automation risk of the Austrian labour market using a huge database of job advertisements, which comprise a major proportion (about 40%) of the total Austrian labour market. This big data source may also be used for further analysis based on text mining to analyse current labour market trends (e.g. its application to green jobs, see Schober and Füllsack, 2017).

4.3. Apprenticeship programmes screening

One project (September 2018 - November 2019), commissioned by BMDW, aimed to systematically screen apprenticeship programmes regarding digital requirements (cf. Chapter 3.2). As a result, a priority list of job profiles (i.e. company-based training curricula) that need to be revised was drawn up. Using quantitative and qualitative methods, it sought to determine if apprenticeship programmes may be updated to meet current and future skills needs of the labour market and digital trends. The quantitative content analysis focused on a systematic screening of all apprenticeship programmes (in total about 200 training regulations: unstructured big data) using the bag of words method (quantitative text analysis) based on a predefined digital competency model (Dornmayr et al., forthcoming).

CHAPTER 5.

VET 4.0 learning practices

There are at least two basic requirements to make new digital learning methods successful: (a) a well-developed IT infrastructure (fast internet connection, wireless local area network (WLAN), digital devices, learning platforms, etc.) and (b) digitally competent teachers (Brandhofer et al., 2016).

A survey on information and communication technology (ICT) in schools (BMB, 2016) shows that in about 90% of schools for intermediate VET and colleges for higher VET, WLAN is available in the classroom. Correspondingly, 90% of schools for intermediate VET and colleges for higher VET use e-learning methods in class, and 45% are equipped as notebook classrooms ([13]). Another survey indicates, however, that teachers are not well-prepared for the challenges of digitalisation ([14]).

5.1. Promoting e-learning platforms

Even though emphasis is put by the Digitalisation Masterplan on reinforcing the basic IT infrastructure (the speed of internet, WLAN, school networks, etc.) in schools, another area of focus is on providing tools to promote the use of digital learning methods in the classroom. For this purpose, several web platforms have been made available to collect and provide tools for e-learning.

The platform eEducation ([15]), for instance, is an initiative of the Federal Ministry of education. Its aim is to promote the development of digital competences to use technology consciously and productively for personal development and to ease access to current and future occupational fields. Schools (at all levels, including intermediate VET and colleges for higher VET) are invited to become a member in order to digitalise their organisation and classroom work. Scenarios focus on the added value of digital media as part of learning processes. The aim is to prepare students to use digital technology at their workplace in a competent way.

([13]) It is a basic requirement for admission to school-based VET programmes that every learner has to buy a notebook computer for his/her own use.

([14]) https://www.ots.at/presseaussendung/OTS_20180911_OTS0068/innovationsstiftung-fuer-bildung-digitalisierung-bleibt-herausforderung-fuer-unser-bildungssystem-bild [accessed 16.12.2019]

([15]) https://eeducation.at [accessed 16.12.2019]

In apprenticeship training, the implementation of e-learning methods is more complex because company-based training takes place as training on the job. The degree of digitalisation in apprenticeship training is strongly depended on the occupation profile and working environment in the training company. If working environment and tools in the training company are driven by digitalisation, then training will also take place in this digital working environment. This is the reason why VET policies on digitalisation in the apprenticeship training system are mainly carried out by revising apprenticeship programmes. For IVET trainers, the web platform https://ausbilder.at on the subject of 'digital learning and training' ([16]) (cf. Chapter 3.2) has been set up. In addition, adult education establishments provide CET programmes for IVET trainers, which also focus on digital forms of learning.

Recently, a digital tool has been made available for apprenticeships in tourism to document and plan training in a pilot project; this aims to safeguard and further develop the quality of apprenticeship training ([17]). The goal is to document the progress made in training and to plan progress for the remainder of the apprenticeship training period. Although this tool is still in the development stage, it is already planned to be extended to other apprenticeship occupations.

5.2. Developing digital competence tools

Furthermore, the BMBWF has developed a reference framework for digital competences on three levels ([18]). The highest level targets students at upper secondary education (including schools for intermediate VET and colleges for higher VET). In this context, a broad set of teaching examples has been made available. Correspondingly, by using the competence assessment tool digi.check students at the primary, lower and upper secondary level can independently test which digital competences they have already acquired ([19]).

Based on the digital competence framework for citizens (DIGCOMP) of the European Commission, the competence model digi.kompP (Digitale Kompetenzen für Lehrende) was introduced to develop the digital competences of teachers (Brandhofer et al., 2016) ([20]). The virtual university college of teacher

([16]) https://ausbilder.at/ [accessed 16.12.2019]

([17]) https://www.ausbildungsfahrplan.at/ [accessed 16.12.2019]

([18]) https://digikomp.at [accessed 16.12.2019]

([19]) https://digicheck.at [accessed 16.12.2019]

([20]) digi.comP was introduced even before the *'Digital Competence Model for Austria DigComp 2.2 AT' was developed* (cf. Chapter 2.1.2)

education ([21]) has set itself the goal of providing continuing professional development for teachers. Its range of programmes comprises online courses (cooperative online seminars, e-lectures, coffeecup learning units) that provide support in acquiring digital competences, i.e. being able to professionally implement technology-assisted teaching in classrooms, and knowledge of current teaching and learning methods. Other university colleges of teacher education are also increasing their offer of e-learning methods.

5.3. Improving MINT attractiveness

In order to attract students to vocational training in the field of Industry 4.0, it is important to encourage them as early as possible to study mathematics, information technology, natural sciences and technology (MINT subjects). In this regard, basic digital education at the primary and lower secondary level is of central importance (Schrack, 2018).

Apart from this, there are numerous initiatives to attract young people to MINT occupations; examples include the *Jugend innovativ* ([22]) and *Sparkling science* ([23]). *Jugend innovativ* makes innovative ideas visible and aims to activate greater creative potential in different categories like science, engineering, entrepreneurship, design and special awards in the categories sustainability and digital education. *Sparkling science* is a programme in which students from all school levels are actively involved in research processes. In these projects, students support researchers in their scientific work and in communicating the joint research results to the public.

In this context there are also special efforts to attract young women to MINT occupations. One very successful example is the *Girls' day*, which is held nationwide once a year. On this day, interested companies and institutions open their doors to girls and present training occupations and study courses in IT, crafts, sciences and technology, in which women are rarely represented. Another example is the platform *meineTechnik* ([24]), which provides an overview of support to overcome barriers to access scientific and technical training and occupations.

([21]) https://www.virtuelle-ph.at [accessed 16.12.2019]

([22]) https://www.jugendinnovativ.at/ [accessed 16.12.2019]

([23]) https://www.sparklingscience.at/ [accessed 16.12.2019]

([24]) https://www.meine-technik.at/ [accessed 16.12.2019]

CHAPTER 6.

Adapting to AI and automation

6.1. AI Strategy Austria

In 2018, the Federal Ministry of Transport, Innovation and Technology (BMVIT) and BMDW jointly published the paper *Artificial Intelligence Mission Austria 2030* (BMVIT, 2018). This paper presents the manifold possibilities arising from the application of artificial intelligence, but also defines seven future fields (including qualification and training, research and innovation, AI in the economy) that need to be adapted in the coming years in connection with AI. It does not define any concrete strategic measures however.

Based on this AI mission, parallel working groups were set up in these seven defined future fields in the first half of 2019, involving around 150 experts from science and academia, business and administration. In several workshops, the experts developed strategic fields of action as well as specific options for action, which were presented in an expert paper to the Federal Government. This will subsequently serve as the basis for drawing up an AI strategy for Austria, which is not yet available (Wiesmüller, 2019). The expert paper summarises five fields of action for the future field of qualification and training: (a) strengthening MINT training and AI competence building (up to the upper secondary level); (b) integrating AI into teacher training; (c) promoting and further developing AI in research and teaching at higher education establishments; (d) application of AI by teachers and learners; and (e) promoting cooperation between science and academia & business & society. The fields of action are each defined by more specific measures. But also in most of the other six future fields, both in the area of challenges and the proposed measures, the issue of education and training is repeatedly addressed, which thus proves to be a key factor for an AI strategy (BMVIT and BMDW, 2019).

6.2. Diversity of education and training programmes

At the tertiary level, there is an increasing diversity of degree courses that deal with the effects of artificial intelligence or which impart methods of artificial intelligence themselves. Examples of this include: Robotics (University of Applied Sciences Wiener Neustadt), Data Science and Business Analytics (St. Pölten University of Applied Sciences), Digital Business Innovation and Transformation (University of

Applied Sciences Krems) or Artificial Intelligence (Johannes Kepler University Linz).

In addition, there are various offers in the field of continuing vocational education and training and in the sector of adult education. The Federal Economic Chamber, for instance, is organising a series of webinars on artificial intelligence which specifically address small and medium-sized enterprises ([25]). Another example is the AI Academy of the adult education institution WIFI NÖ (Institute for Economic Promotion Lower Austria). This academy was set up in November 2019 and is designed as a four-stage CET course with the focus on AI issues ([26]).

But also in VET at the secondary level there is a constantly growing range of training courses and specialisations focusing on these topics. Whereas in many technical training courses, both in school-based VET and in apprenticeship training, the areas of automation and robotics represent the main fields of specialisation, new offers can be found in commercial programmes or in tourism, for example, in particular with the focus on digital business.

It is also discussed whether there is a need for a specific apprenticeship in the field of artificial intelligence and how such an apprenticeship programme could be designed. However, experts from industry and science often consider it more sensible to review existing training courses for possible fields of application for AI and to integrate the necessary training content in the apprenticeships concerned.

6.3. Specific support programmes focus on prevention

In order to combat possible consequences of automation such as unemployment, preventive support programmes for IVET and CET are being implemented above all at regional level.

For employed adults there are specific support programmes for qualification and CET measures in the field of digitalisation ([27]). The aim of these programmes

([25]) https://www.wko.at/service/innovation-technologie-digitalisierung/kuenstliche-intelligenz.html [accessed 16.12.2019]

([26]) https://www.noe.wifi.at/artikel/1449-meilenstein-fuer-kuenstliche-intelligenz-in-noe-ki-space-am-wifi-eroeffnet [accessed 16.12.2019]

([27]) For example: Digi-Winner (Vienna): https://www.waff.at/foerderungen/digi-winner/ [accessed 16.12.2019]; Sonderprogramm "Arbeitswelt 4.0 – Fit für Digitalisierung" (Niederösterreich): http://www.noe.gv.at/noe/Arbeitsmarkt/foerderung_Arbeitswelt40.html [accessed 16.12.2019]

is to develop digital skills, ensure better job security, find new opportunities on the labour market and make use of the opportunities offered by digital CET.

Together with cooperating companies, AMS implements qualification alliances at the regional level. At the initiative of AMS (and other local actors), companies are joining forces to identify CET needs and provide tailored CET in order to manage the digital transformation within companies ([28]).

([28]) For example in Tyrol: https://www.ams.at/regionen/tirol/news/2019/05/impuls-qualifizierungsverbund-digitalisierung--mitarbeiterinnen- [accessed 16.12.2019]

CHAPTER 7.

Conclusions – main challenges and outlook

Austria has only recently developed a comprehensive digitalisation strategy. Work on an AI strategy is still ongoing. However, there are now great efforts to develop and implement related policy actions and measures. This applies to the field of general education and also VET, in which many projects and measures are being developed and implemented to face the challenges of digitalisation in a comprehensive way. Especially in VET, with its long tradition in Austria, efforts to adapt curricula (in school-based VET) and apprenticeship programmes are linked to already existing (and working) processes and mechanisms to adjust training contents. VET can only be successful if there is a permanent adjustment of contents to the requirements of the labour market.

Digitalisation and AI is a key priority of the current government programme. In this context, there is the risk that this term will be reduced to a slogan that sells well in the political arena. Undoubtedly, digitalisation of VET offers great potential for further development. But it is not a panacea solving all problems in the VET system. With the strong focus on digitalisation there is the risk that other important problems in VET (e.g. decrease of training companies) are neglected.

One central challenge is to implement the manifold project-based approaches to tackling digitalisation on a structural level. This can only be achieved with a step-by-step procedure and by making huge efforts. The central prerequisite for making digital transformation in VET successful is that teachers have or acquire digital pedagogical competences. As teachers do not feel well prepared in Austria at present, much effort (further education and training, basic pedagogical education) is needed to develop the digital competences of the pedagogical workforce in VET. Another relevant example is that despite strong commitment to digitalisation, there is still a lack of well-equipped digital workspaces in schools for teachers. Additionally, surveys show that part-time vocational schools for apprentices are not as well equipped as schools for intermediate VET and colleges for higher VET (BMB, 2016).

Digitalisation on the labour market creates a demand for VET being provided at a higher level and for the acquisition of transversal competences. In this respect it is worth discussing under what conditions the apprenticeship training system is able to meet these requirements. In particular, there is a need to discuss how apprenticeship training can be further developed so that enterprises are able to create appropriate working and learning environments even where CET requirements are higher and broader.

It can be concluded that currently many efforts are being made by VET policy-makers to develop and implement appropriate measures for facing the challenge of digitalisation. But the process has just begun and there will be a lot of challenges ahead.

Abbreviations and acronyms

AI	artificial intelligence
AT	Austria
AMS	Arbeitsmarktservice [Public Employment Service Austria]
BMBWF	Federal Ministry of Education, Science and Research
BMDW	Federal Ministry for Digital and Economic Affairs
BMVIT	Federal Ministry for Transportation, Innovation and Technology
Cedefop	European Centre for the Development of Vocational Training
CET	continuing education and training
DESI	Digital Economy and Society Index
DIA	Digitalisation Agency
DIGCOMP	digital competence framework for citizens
EU	European Union
ICT	information and communication technology
IT	information technology
IVET	initial vocational education and training
MINT	Mathematics, Informatics, Natural Science and Technology
MOOCS	Massive Open Online Courses
OECD	Organisation for Economic Co-operation and Development
PIAAC	Programme for the international assessment of adult competencies
smOOC	small open online course
VET	vocational education and training
WIFI NÖ	Institute for Economic Promotion Lower Austria
WKO	Austrian Economic Chamber
WLAN	wireless local area network

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