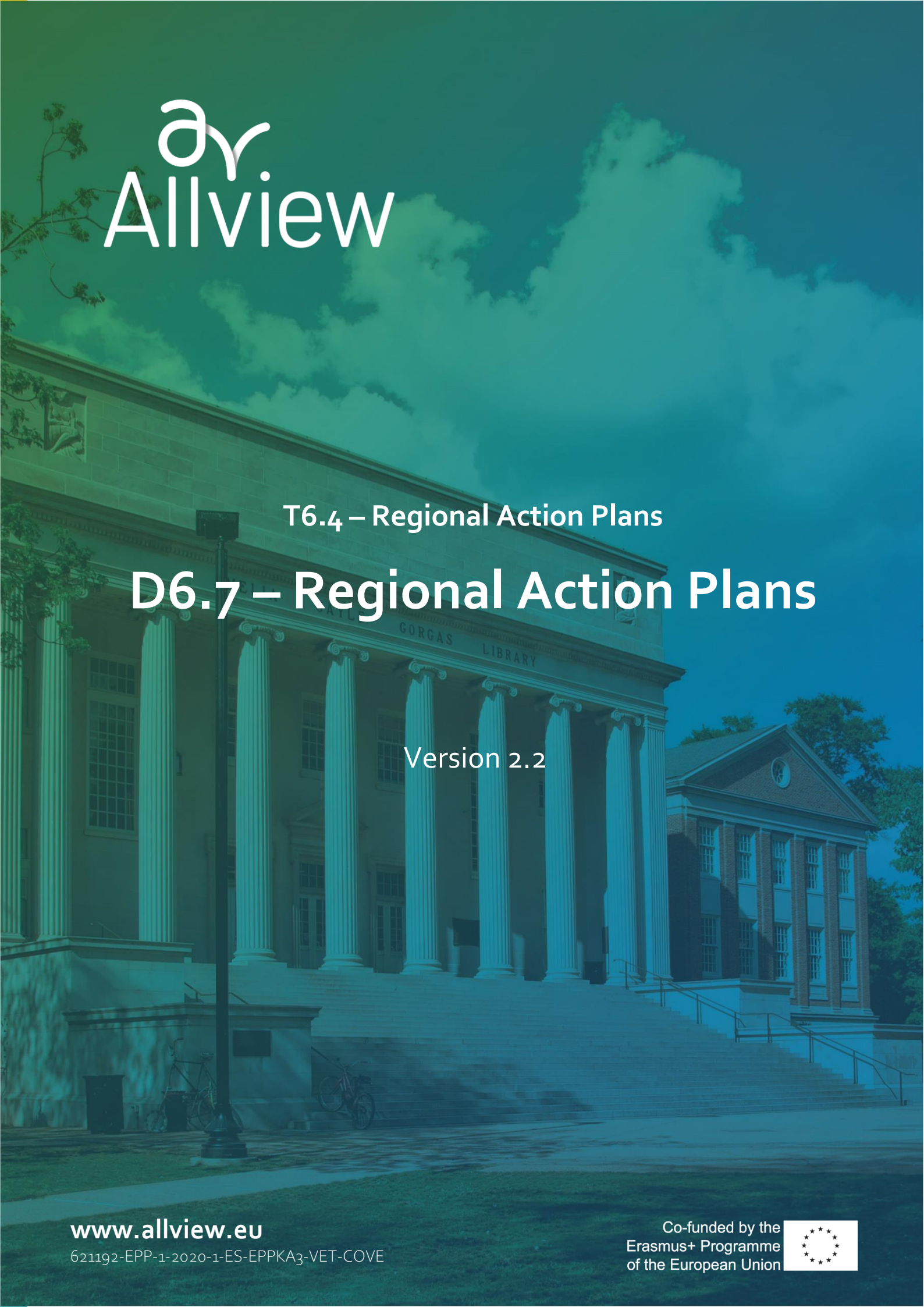

Allview

T6.4 – Regional Action Plans

D6.7 – Regional Action Plans

Version 2.2

www.allview.eu
621192-EPP-1-2020-1-ES-EPPKA3-VET-COVE

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

This project has been funded with the support of the Erasmus+ programme of the European Union

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

Sommario

Allview

1

Introduction

1. Introduction

This report is the result of joint efforts by EURADA and NIVET according to the roles distribution in WP6. Feedback from one representative per country is also collected as for the following partners: FCBA, SITILD, HMC, HDH, FLA. The meaning of this activity was to set up the fundamentals of the strategic tasks with regards to the Recognition and Validation of VET programmes within Regional Plans.

Based on NIVET instructions, partners received a plan for organizing the submission, synthesis, and delivery of the strategic report based on the case studies. The scheduled actions outlined a clear path for the successful completion of the WP6 and the delivery of D6.8 by M48. Adhering to this scheduled with a coordinated approach allowed to ensure a structured approach to synthesizing case studies and developing a strategic report that offers valuable insights and recommendations.

NIVET went through all submitted case studies to identify key themes, insights, and validation strategies and they organized case studies based on relevant criteria (e.g., geographic region, industry, strategy type). Furthermore, the purpose was also to identify patterns, look for common challenges, solutions, and outcomes across the cases.

The present report summarizes findings and highlights strategic insights which will be validated by RSGs before the end of the project bringing up new guidelines that will be complementing past conclusions as for D6.3 Minutes of constitution of Stakeholder Working Groups.

Allview

2

Case studies

2. Case studies

As a matter of fact, the consortium priority is to meet the needs of industry by leading, designing and recognising updated VET programmes and EU guidelines for developing sustainable future policies.

Four common pillars have been recognised so far:

a. Capacity building on technology (Digitalisation | Industry 4.0)
b. Promotion of internships (attention to regulations and policies)
c. Green approach and Environmental Sustainability (eco-friendship | circular economy | upcycling)
d. Corporate Social Responsibility (CSR) and AL environments

The project deliverable D6.7 Regional action plans is mainly focused on 3 thematic areas: Industry 4.0, Ambient Assisted living (ALL) and Circular Economy. The way partners involved in the project are use to develop new curricula is very different and the corresponding official bodies recognising new curricula apply varied methods and national regulations.

Partners have also identified different qualifications in the wood and furniture sector at secondary level and so it was decided to check at EQF 4 AND EQF 5 level which knowledge and skills in the fields of Circular Economy, Industry 4.0 and Ambient Assisted Living were already included in existing qualifications.

Then partners were asked to prepare case studies according to the following structure:

1. Presentation of the bodies involved in updating the curricula.
2. Presentation of qualifications at EQF 4 and EQF 5 in the wood and furniture sector.
3. An overview of the knowledge and skills in the field of the Circular Economy, that are already included in qualifications at EQF 4 and EQF 5 levels and suggested in »Pathways to HE«. See below.
   - Eco Design
   - Cascading use
   - Reneweble energy sources
   - Efficient and sustainable productions
   - Environmental effects
   - Circular business models
   - Industry symbioses
   - Biotechnology
   - System thinking
   - Waste energy
   - Biorefinery
   - Green chemicals
   - Bioeconomy
   - Systematic thinking
   - Waste to energy
   - Biorefinery
   - Green chemicals
   - Bio economy
   - Functional materials (susteinable composites, advanced materials)
   - LCA analyses
   - Collestion and recycling
   - Transperancy in supply chains
   - Hazardous chemicals
   - Green public procurement
   - Nano technology

4. Industry 4.0, that are already included in qualifications at EQF 4 and EQF 5 levels and suggested in »Pathways to HE«:
   - Cross reality (VR, AR, MR)
   - Cloude computing
   - Online security
   - Internet of things (IoT)
   - Simulations
   - Autonomous (smart) robots
   - Big data
   - Additive productions -3D, 4D printing
   - Artificial intelligence

5. Ambient Assisted Living (AAL), that are already included in qualifications at EQF 4 and EQF 5 levels and suggested in »Pathways to HE«:
   - Smart buildings
   - Smart furniture
   - Ergonomic interior design
   - Sensors
   - Fire and other safety

The final goal is to work out a proposal to complement existing qualifications with Circular economy, Industry 4.0 and AAL skills and knowledge at EQF 4 and EQF 5 level in the Wood and Furniture sector based on the results of their case studies.

The methodology shared by the working group was defined during the consortium meeting in Barcelona. As a result practical cases have been described as follows:

- Chapter 1: Presentation of the body involved and documents that are the bases for updating curricula with a few sentences to describe which body is responsible and which documents are used to update the curricula (for instance: occupational standards, occupational profiles, catalogues of knowledge etc.)
- Chapter 2: Qualifications in Wood and furniture sector (EQF4, EQF5) - qualifications in Wood and furniture sector that are available on level EQF 4 and EQF 5 in each country/region/sector are illustrated.
- Chapter 3: Processes including AAL, Industry 4.0 and Circular Economy - For the purpose of this chapter, a table was made. In the left column there are names of the modules that include skills and knowledge from Circular Economy, Industry 4.0 and AAL. In the middle column there are skills and knowledge (from Circular Economy, Industry 4., AAL. Column on the right side of the table lists skills and knowledge suggested in Pathways to HE.
- Chapter 4: A proposal to complement existing qualifications with Circular economy, Industry 4.0 and AAL skills and knowledge at EQF 4 and EQF 5 level in the Wood and Furniture sector.

Allview

3

Observation of regional plans

3. Observation of regional plans

The observation of the state-of-the-art in the sector in Europe relies on the evidence of different contexts among partners and their local stakeholders.

The single case of FCBA is studied. They offer training courses for furniture professionals and students, with an emphasis on materials and ergonomics. They are not a dedicated training centre, but they offer one-off training courses and are attached to a training centre (Qualiopi) which validates their training courses.

The training courses offered by the FCBA Institute of Technology are updated by the experts who provide them. The experts are in close contact with the institutions responsible for regulations and qualifications. These courses are designed for professionals or for students with a level corresponding to EQF 6, EQF 7, EQF 8.

There are also other institutions, such as the AFPIA, les Compagnons du Devoir, apart from universities, which provide training for the wood sector in which the FCBA is involved. These courses are validated by a certificate awarded by the training institution. These courses are designed for professionals or for students with a level corresponding to EQF 4, EQF 5, EQF 6, EQF 7.

On the contrary, in Germany several bodies and organizations typically play vital roles in the process of updating qualifications and key documents related to designing qualifications. These entities collaborate to ensure that qualifications remain relevant, responsive to industry needs, and aligned with educational standards. Collaboration and consultation among these entities ensure that qualifications are updated to meet the demands of changing industries, technological advancements, and societal needs while maintaining quality and relevance in vocational training and education. In Germany the Ministry of Economy is in charge to update qualifications. The updating process can be started by associations, trade unions, chambers or companies. They work together with the Board of Trustees of the German Industry for Vocational Training (KWB). After starting the update process the KWB will initiate an expert panel from companies, schools and organizations. This panel is in charge to work out the updates and present the results to the Ministry of economics, which will publish the new training regulations.

Vocational education and training (VET) programmes in Slovenia are based on one or more occupational standards that are developed through social dialogue within the sector. Occupational standard defines the expected knowledge, skills and competences that a qualification holder must possess at a certain level of proficiency. In the wood and furniture sector proposals for updating the occupational standards are forwarded to the Sectoral Committees for production technology, which approve new or revised content. Once approved by the Sector Committee, the VET programme is updated in accordance with the changes in occupational standards. The VET programmes are competence-based and modularised. For each vocational module, a catalogue of knowledge is prepared at national level.

In the Netherlands, the foundation for cooperation on Vocational Education and Training (VET) and the labour market (SBB) is responsible for developing and maintaining the qualification structure for vocational education. SBB aims to ensure a strong connection between education and the job market.

In addition, they are responsible for establishing and maintaining VET qualification files and electives:

1. Qualification files describe the requirements that students must meet to obtain a specific qualification in VET:
    - they consist of various components, such as the description of the profession, core tasks and work processes, required knowledge, skills and professional competencies.
    - SBB develops qualification files in consultation with representatives from the business sector, educational institutions, and other relevant stakeholders. This is done through qualification file committees.
    - These committees study developments within specific professional groups, the needs of the business sector and any changes in laws and regulations. Based on this, the content and requirements of the qualification files are determined or revised.
2. Electives, which are:
    - parts of the VET programme that offer students the opportunity to specialize or broaden their education. They are intended to better meet the needs of the labour market or the personal interests of the student.
    - developed by SBB in consultation with the same stakeholders as in the case of qualification files, including representatives from the business sector, education, and industry organizations.
    - based on current developments in the field, needs from the work field, and input from the education field. They can, for example, focus on new technologies or specific skills.
    - additions to students' regular training programmes, provided that certain conditions are met, such as obtaining the associated qualification and successfully completing the core tasks.

Through this structural collaboration between education and business, SBB ensures that qualification files and electives are relevant, up-to-date and align well with labour market requirements. This contributes to the quality and relevance of secondary vocational education in the Netherlands.

In Belgium Curricula are created in an interplay between professional qualifications and minimum objectives, which form together a curriculum file. A professional qualification is written by the wood industry sectors. This determines what a graduate student must be able to do and know to function within this professional field. In addition, minimum objectives are set by the government, the Flemish government. This concerns the general development of a student's character. Both elements come together in a curriculum file and are transformed into a curriculum by a curriculum committee (a selection of teachers from the wood training courses).

In Italy, Vocational education and training (VET) programs are designed in a multilevel dialogue among the Ministry of Education, the Ministry of Labour and Social Policies, the Regions where the specific programs are delivered, the Autonomous Provincies, the different stakeholders involved, such as chambers of commerce, companies, employer and trade unions, VET centers, institutional bodies. Such dialogue in grounded on the supply and demand analysis of skills and competences that each industrial sector outlines. While the Ministries draw the guidelines to structure the vocational education and training systems, the Regions and Autonomous Provinces are responsible to implement these systems. The dialogue between the state and regional levels is guaranteed by the Conferenza Stato-Regioni (state-region conference). Since the programs are regionally defined, to provide an example it is possible to briefly analyze the case of Lombardy Region. In this region, competences and professional profiles are classified by the Regional Framework of Professional Standards (Quadro Regionale degli Standard Professionali – QRSP), which is built upon the National Repertoire and the National System of Skills Certification. The QRSP is structured in twenty-four professional economic sectors from the National Repertoire and presents six sections: (1) professional profiles and independent skills; (2) basic skills; (3) cross-sectoral/soft skills; (4) bio-natural skills; (5) regulated/enabling skills; (6) regulated training paths. The Regional Framework of Professional Standards is correlated to the Atlas of Work and Qualifications, a document that link different economic-professional sectors to the levels of the National Framework of Qualifications.

Staying in Southern countries, the Certificates of Professionalism are the Spanish official accreditation tool for the professional qualifications of the National Catalog of Professional Qualifications in the field of Labor Administration.
The Certificate of Professionalism, regulated by Royal Decree, will be official and valid throughout the national territory and will be issued by the State Public Employment Service and the competent bodies of the Autonomous Communities.
In the case of the wood, furniture and cork family, 18 Professional Certificates can be found at the state level, but only 10 are taught in the different training centers located in the Autonomous Community of the Region of Murcia. The Professional Certificates correspond to levels 1,2 and 3, which translated into the European Qualifications Framework correspond to EQF 2, 3, 4 and 5

Finally, in Poland VET has three governance levels: national (ministries), regional (school superintendents, mainly in pedagogical supervision) and county (powiat – managing schools). The Ministry of Education and Science consolidates tasks relating to education, higher education, and science within one institution. It is also in charge of VET policies at all levels, supported by other ministries responsible for particular occupations. Social partners advise policy makers on necessary changes in VET.

The ministry is supported by the Vocational School Directors Council (Rada Dyrektorów Szkół Zawodowych) established as a consultative body in 2018. It consists of 42 school directors from vocational schools representing all regions of the country and different sectors. In each region, education authorities appointed coordinators – in total 31

coordinators – for vocational education and training, responsible for supporting cooperation between schools and employers, as well as promoting activities to develop vocational guidance and counselling in the education system. Most public education institutions in Poland are managed by local government units. Counties (powiaty) are responsible for upper secondary schools, including vocational schools, and schools for children with special needs; the regions (województwa) are responsible for schools of regional and trans-regional significance, such as groups of schools or vocational schools important for the regional economy.

Central government units (usually ministries) often manage vocational and fine arts schools. All types of schools can be established and managed by non-public institutions, such as religious and social associations. The share of non-public institutions is increasing as the level of education is higher.

The VET programmes available at the national level are developed on the basis of three regulations of the education ministry:

- the classification of occupations for vocational education;
- the core curricula for vocational education;
- the core curriculum for general education.

The classification includes the list of occupations for which VET programmes can be provided. Qualifications are distinguished within occupations; each occupation can be made up of either one or two qualifications.

The introduction of new occupations to the classification is regulated by the Education Law. The classification of occupations is determined by the education minister in cooperation with the relevant ministers responsible for a given sector of the economy, who can submit their requests to include particular occupations in the classification. To anticipate labour market needs, representatives of employers and employees are consulted during the development stage of the classification.
Regarding to updating it should be pointed that professional associations, organisations of employers, sector skills councils, social partners and other stakeholder organisations can submit their proposals to the relevant minister to establish a new occupation; in this way they shape the educational offer of the formal VET system. After the proposal has been approved, the education minister includes the occupation in the classification and appoints a working group to design the core curriculum for vocational education for that occupation.

The working group contacts the institution which submitted the proposal for the new occupation to determine the learning outcomes; it then undertakes consultations with other experts in the field. At this stage, occupational standards, which are developed by the labour ministry, are considered.

The decision to provide education for a particular occupation listed in the classification of occupations for vocational education is made at local level by the school principal in agreement with local authorities (county level) and after asking the regional labour market councils (advisory bodies) for their opinion concerning compliance with labour market needs. Teaching programmes can be developed individually by schools. The school

principal is responsible for incorporating the learning outcomes in the teaching programme and providing the organisational requirements as defined in the core curricula.

Allview

4

Recommendations

4. Recommendations

The term heterogeneity can sum up the main findings through the observation of our sample European regions but the debate among partners and stakeholders brought up valuable key ideas to improve common recognition processes in the future.
The current report is based on single regional cases that are described in detail in single reports available for consultancy in the Teams WP6 area.

Generally speaking and based on the review presented in the tables they contain, we have concluded that some Circular economy, Industry 4.0 and AAL skills and knowledge are missing and should be updated in the existing qualifications. Lists are not exhaustive but they highlight the urgent need to integrate sustainable and digital skills and knowledge into VET educational and training programmes. These identified gaps are crucial for adapting our qualifications to the evolving needs of the modern workforce and expectations. By integrating these skills and knowledge, we aim to improve the relevance and applicability of our VET programmes, equipping learners with the essential skills they need to thrive in a rapidly changing global environment, particularly in the specialised wood and furniture sector.

Having examined some Professional Certificates (see i.e. Spain), we believe that it is necessary to update the training received by students in terms of concepts related to the circular economy and the use of new technologies, to be able to cope with the rapid changes that arise in the wood and furniture sector. Updated training allows for improved skills and greater job insertion of workers within the sector. At the same time, companies can face the challenges presented to them to be more competitive in a demanding global market

In the current curriculum ample attention is paid to circular economy and industry 4.0 in the basic school subjects as well as electives and other components. However, to stay future proof the aim to is set up the school in such a way that innovations are given a permanent place. There is a constant focus to search for information about sustainable and innovative materials to be integrated into the curriculum. The life cycle analysis (LCA) an important tool to measure in an objective manner the level of sustainability of materials. A disadvantage is that many materials do not yet have an LCA. Therefore, tools that can easily classify materials according to their degree of sustainability, such as intermatter, are investigated for. New techniques are discussed in various electives in the Netherlands that students can choose based on their own interests. A more prominent place for it in the basic school subjects and components is desired. For this, it is necessary to train teachers and instructors and make them enthusiastic. Sometimes there seems to be some 'fear' of new techniques because they think the old craft will disappear as a result.

Because developments in the field of new techniques are moving so fast, we find it important to teach students and encourage teachers and instructors to remain inquisitive. AI is going to play a big role in the industry in the future. Concerning AAL, students need to be able to design furniture with sensors incorporated into it, so that people can live

independently at home for longer. Since this subject is not described in the compulsory learning objectives of the study programmes, we encourage to include it in home automation modules. The processing of light in furniture using sensor technology is a skill that is important for students to learn too.

Finally, safety appears to be a relevant topic when it comes to furniture design. Students should have knowledge about the flammability and toxicity of materials they work with. The curriculum will be looked at profoundly to see if enough attention has already been paid to this subject.

The above assumptions will leave place to key suggestions in future Action Plans.

Allview

5

Useful links

5. Useful links

- https://www.holzbau-deutschland.de/holzbau_deutschland/handlungsfelder/berufsbildung/anhttps://nabor.pcss.pl/poznan/szkolaponadpodstawowa/Informator/SchoolBranchDetails/102860
- https://wtd.sggw.edu.pl/strefa-studenta/program-studiow-i-sylabusy/
- https://www.drzewna.com/pl/szkola/technikum-drzewne,243.html
- https://www.mzsp.pl/kierunki/kierunki.php?id=25
- https://www.ore.edu.pl/wp-content/uploads/2020/03/technik-technologii-drewna.pdf
- https://europass.europa.eu/pl/description-eight-eqf-levels
- https://prk.men.gov.pl/en/1en/
- https://eurydice.eacea.ec.europa.eu/national-education-systems/poland/overview
- sicht/detail/eqf_timber_berufsbildung_im_holzbau_qualifikationen_sichtbar_machen/
- https://lms.hnee.de/enrol/index.php?id=1752
- https://www.hnee.de/de/Fachbereiche/Holzingenieurwesen/Fachbereich-Holzingenieurwesen-der-HNE-Eberswalde-K241.htm
- https://www.bfh.ch/ahb/en/studies/master/wood-technology/
- *https://nabor.pcss.pl/poznan/szkolaponadpodstawowa/Informator/SchoolBranchDetails/102860*
- *https://wtd.sggw.edu.pl/strefa-studenta/program-studiow-i-sylabusy/*
- *https://www.drzewna.com/pl/szkola/technikum-drzewne,243.html*
- *https://www.mzsp.pl/kierunki/kierunki.php?id=25*
- *https://www.ore.edu.pl/wp-content/uploads/2020/03/technik-technologii-drewna.pdf*
- *https://europass.europa.eu/pl/description-eight-eqf-levels*
- *https://prk.men.gov.pl/en/1en/*
- *https://eurydice.eacea.ec.europa.eu/national-education-systems/poland/overview*
- *https://www.metiers-foret-bois.org/etablissements/bac-pro-technicien-menuisier-agenceur?mo=%2C3%2C*
- *https://www.letudiant.fr/etudes/bts/bts-du-secteur-bois.html*
- *https://www.onisep.fr/ressources/univers-formation/formations/post-bac/bts-developpement-et-realisation-bois*
- *https://etudiant.lefigaro.fr/vos-etudes/etudes-superieures/33910-bts-drb-definition-debouches-et-salaire/*
- *https://eduscol.education.fr/sti/formations/bac-pro/bac-pro-technicien-menuisier-agenceur-tma#presentation*
- *https://www.letudiant.fr/bac/bac-pro/article/bac-pro-tma-technicien-menuisier-agenceur-alt-liste-bac-pro-btp-batiment-et-travaux-publics-10312.html*
- *https://www.esb-campus.fr/wp-content/uploads/2023/10/VF-FichesFormations_ESB_BACHELOR_2024.pdf*
- https://www.dqr.de/SiteGlobals/Forms/dqr/en/qualifikationssuche/search_form.html?
- nn=469104&resourceId=365954&input_=469104&pageLocale=en&templateQueryStringQualifikationssuche=wood+&submit=
- https://www.wki.fraunhofer.de/en/career/Training-offers/Wood-Technician.html
- https://de.wikipedia.org/wiki/Holztechniker
- https://www.bibb.de/en/39.php
- https://www.daa-technikum.de/lehrgaenge/staatlich-gepruefter-holztechniker

- https://huebsch.karlsruhe.de/beruf/technikerschule-holztechnik/
- https://www.bm-online.de/aktuelles/markt-branche/kreislaufwirtschaft-in-der-holzverarbeitung-foerdern/
- https://www.bfh.ch/de/studium/bachelor/holztechnik/
- https://www.th-rosenheim.de/studium-und-weiterbildung/studienangebot-der-th-rosenheim/bachelorstudiengaenge/international-bachelor-of-wood-technology?
- https://www.dqr.de/dqr/shareddocs/downloads/media/content/dqr_handbuch_01_08_2013.pdf?__blob=publicationFile&v=1
- https://www.hawk.de/sites/default/files/2023-04/pobt_b_84_holzingenieurwesen_2020_fassung2023_hawk.pdf
- https://www.hawk.de/sites/default/files/2023-04/verkuendungsblatt_hawk_2023_06_0.pdf
- https://www.holzbau-deutschland.de/holzbau_deutschland/handlungsfelder/berufsbildung/ansicht/detail/eqf_timber_berufsbildung_im_holzbau_qualifikationen_sichtbar_machen/
- https://lms.hnee.de/enrol/index.php?id=1752
- https://www.hnee.de/de/Fachbereiche/Holzingenieurwesen/Fachbereich-Holzingenieurwesen-der-HNE-Eberswalde-K241.htm
- https://www.bfh.ch/ahb/en/studies/master/wood-technology/
- https://www.metiers-foret-bois.org/etablissements/bac-pro-technicien-menuisier-agenceur?mo=%2C3%2C
- https://www.letudiant.fr/etudes/bts/bts-du-secteur-bois.html
- https://www.onisep.fr/ressources/univers-formation/formations/post-bac/bts-developpement-et-realisation-bois
- https://etudiant.lefigaro.fr/vos-etudes/etudes-superieures/33910-bts-drb-definition-debouches-et-salaire/
- https://eduscol.education.fr/sti/formations/bac-pro/bac-pro-technicien-menuisier-agenceur-tma#presentation
- https://www.letudiant.fr/bac/bac-pro/article/bac-pro-tma-technicien-menuisier-agenceur-alt-liste-bac-pro-btp-batiment-et-travaux-publics-10312.html
- https://www.esb-campus.fr/wp-content/uploads/2023/10/VF-FichesFormations_ESB_BACHELOR_2024.pdf
- https://www.dqr.de/SiteGlobals/Forms/dqr/en/qualifikationssuche/search_form.html?
- nn=469104&resourceId=365954&input_=469104&pageLocale=en&templateQueryString Qualifikationssuche=wood+&submit=
- https://www.wki.fraunhofer.de/en/career/Training-offers/Wood-Technician.html
- https://de.wikipedia.org/wiki/Holztechniker
- https://www.bibb.de/en/39.php
- https://www.daa-technikum.de/lehrgaenge/staatlich-gepruefter-holztechniker
- https://huebsch.karlsruhe.de/beruf/technikerschule-holztechnik/
- https://www.bm-online.de/aktuelles/markt-branche/kreislaufwirtschaft-in-der-holzverarbeitung-foerdern/
- https://www.bfh.ch/de/studium/bachelor/holztechnik/
- https://www.th-rosenheim.de/studium-und-weiterbildung/studienangebot-der-th-rosenheim/bachelorstudiengaenge/international-bachelor-of-wood-technology?
- https://www.dqr.de/dqr/shareddocs/downloads/media/content/dqr_handbuch_01_08_2013.pdf?__blob=publicationFile&v=1
- https://www.hawk.de/sites/default/files/2023-04/pobt_b_84_holzingenieurwesen_2020_fassung2023_hawk.pdf

- https://www.hawk.de/sites/default/files/2023-04/verkuendungsblatt_hawk_2023_06_0.pdf

Allview

Annex 1

Regional Case Studies

6. Annex 1: Regional Case Studies

CASE STUDY: Belgium

1. BODIES INVOLVED IN THE PROCESS OF UPDATING QUALIFICATIONS AND KEY DOCUMENTS FOR THE DESIGN OF QUALIFICATIONS

Curriculums are created in an interplay between professional qualifications and minimum objectives, which form together a curriculum file.
A professional qualification is written by the wood industry sectors. This determines what a graduate student must be able to do and know to function within this professional field. In addition, minimum objectives are set by the government, the Flemish government. This concerns the general development of a student's character.
Both elements come together in a curriculum file and are transformed into a curriculum by a curriculum committee (a selection of teachers from the wood training courses).

2. QUALIFICATIONS IN THE WOOD AND FURNITURE SECTOR AT EQF 4 AND EQF 5 LEVEL

Sint-Paulusschool campus VTI Waregem in Belgium is a technical secondary school and has two qualifications corresponding to EQF 4 in the wood and furniture sector. Sint-Paulusschool campus VTI Waregem has no qualifications in EQF 5 and because of this we cannot provide information about EQF 5.

The two qualifications in EQF 4:

- Wood techniques
- Construction and wood sciences

For the purpose of this task, we have selected the qualification Wood techniques at EQF level 4.

EQF 4: WOOD techniques - Occupational competences
The learning content is summarized here

Design methods, modeling, realization techniques in technical processes and systems.
Through an integrated project-based approach, students learn to analyze, develop and apply technical processes and systems in the realization of interior elements and furniture, straight stairways and quarter-turn stairs, interior and exterior carpentry, roof constructions and timber construction systems with CNC-controlled woodworking machines. They always use the latest systems and technologies such as virtual and augmented reality to experience implementations, techniques and conflicts during preparation, implementation of projects, machine settings and error analysis and when collecting digital data. The students perform 3D measurements, model in 3D in CAD, use professional optimization software and with CAM they control production on CNC-controlled woodworking machines. Care for the environment, safe and ergonomic working and circular economy are a common thread throughout the course of study.

Interactions between science, technology, engineering and mathematics
The students think in terms of the technical process and make the link between the different STEM disciplines ('Science', 'Technology', 'Engineering' and 'Mathematics') in a concrete

context. In doing so, the STEM goals are used as cross-curricular thinking and perspectives to address the challenges of answering questions. The students illustrate the interaction between science, technology, mathematics and society on the basis of social challenges.

3. CIRCULAR ECONOMY, INDUSTRY 4.0 AND AMBIENT AND ASSISTED LIVING (AAL) SKILLS AND KNOWLEDGE THAT ARE ALREADY INCLUDED IN THE EXSISTED OBJECTIVES WOOD TECHNIQUES IN EQF 4

(Sint-Paulusschool campus VTI Waregem has no qualifications in EQF 5 and because of this we cannot provide information about EQF 5)

Explanation of the tables below
The first column contains the numbers of the objectives that exist in the wood techniques curriculum (in EQF 4) related to the Circular Economy, Industry 4.0 and AAL.
In the second column the objectives are noted (in bold) and explained in detail. Key words are also added.
The third column contains skills and knowledge suggested in Pathways to HE. Skills and knowledge that are already included in the educational programme are marked green and those that are not are marked in black color.

EQF 4 - WOOD TECHNIQUES

Table 1: EQF 4 - Wood Techniques: Circular Economy skills and knowledge already included in the objectives

OBJECTIVES	Circular Economy skills and knowledge already included in the objectives	Circular Economy skills and knowledge suggested in »Pathways to HE«
Objective 12	**The students make the connection between the sustainability classes of solid wood and wood-destroying organisms.** Sustainability class can be viewed from different points of view. (correctly apply the correct sustainability class for the suitable product) e.g. it is not always necessary to choose a tropical type of wood. You can also use circular materials, from local origin	• Eco Design • Cascading use • Natural resources management • Renewable energy sources • Efficient and sustainable productions • Environmental effects • Circular business models • Industry symbioses • System thinking implementation • Biorefinery • Green chemicals • Bio economy
Objective 14	**The students analyze properties of materials and constructions in function of thermal insulation.** Properties of materials can be viewed broadly and from a circular point of view. An awareness for students. Calculations are made to determine the U-value and thermal resistance in structures and to make the right choices for implementation. All this in function of sustainability, sustainable living	

	environment in a building, heat resistance, indoor and outdoor climate.	• Functional materials (sustainable composites, advanced materials) • LCA analyses • Collection and recycling • Transparency in supply chains • Hazardous chemicals • Green public procurement • Nano technology
Objective 17	**The students illustrate the interaction between science, technology, mathematics and society on the basis of social challenges.** With this objective, we can start from the ecological footprint of materials, raw materials and products, where circularity plays an important role. Students can conduct research into the choice of materials and construction in construction projects, with attention to climate changes and the need for sustainable construction. Students must pay attention to the careful use of raw materials and energy consumption by focusing on optimal production processes.	
Objective 18	**The students prepare the raw materials for the work assignment.** Students learn how to perform a visual quality control on solid wood and panel material with cladding material. Have the students pay attention to dividing, redistributing and the temporary storage of residual material. The students learn to draw efficiently on the raw materials, cut and finish in relation to economic actions. The students use their own material list and optimization plan for sheet materials.	
Objective 43	**The students sort residual material and waste according to instructions received and in accordance with safety and environmental regulations.** The students learn to act correctly in accordance with the agreements, safety and environmental regulations and sorting rules with attention to the circular economy. Have the students investigate what happens to the waste flows and residual materials from their own project after leaving the workshop or site. Let the students learn the influence of sorting on waste processing and recycling. Teaching students, a critical view of waste and residual materials in terms of careful handling of materials and reuse in a circular economy.	

	The students learn to take into account zero-emission or low-emission site transport, local trade, just think of the types of wood that do not always have to come from the other side of the world, and the conscious sustainability of local wood types.	

Table 2: EQF 4 - Wood Techniques: Industry 4.0 skills and knowledge already included in the objectives

OBJECTIVES	Industry 4.0 skills and knowledge already included in the objectives	Industry 4.0 skills and knowledge suggested in »Pathways to HE«
Objective 1	**The students act in a team (organizational culture, communication, procedures)** By acting in a team, students learn the organizational culture, internal communication and procedures. Students learn to follow directions, report problems, communicate and report.	• Cross reality (VR, AR, MR) • Cloud computing • Online security • Internet of things (IoT) • Simulations • Autonomous (smart) robots • Big data • Additive productions -3D, 4D printing • Artificial intelligence
Objective 22	**The students analyze properties of constructions and connection techniques in relation to implementation with CNC-controlled woodworking machines.**	
Objective 24	**The students perform 3D measurements for modeling projects.** In preparation for modeling in 3D, 3D measurements are carried out to model and generate implementation drawings based on the collected projects. This concerns height, horizontal and angular measurements.	
Objective 26	**The students model structured projects in 3D with CAD and convert them into production drawings for CNC machining.** In terms of production drawings and CNC programs, it is essential to pay a lot of attention to well-structured and constructed drawings and the efficient use of layers. The students learn to deal with data management and drawing agreements. Sketches and observational sketches can be used as a means of communication in preparation for CAD drawing.	
Objective 27	**The students use digital technologies to prepare and carry out their assignment.** XR (extended reality) Digital layout tools and measuring equipment The students are introduced to AR and VR in terms of basic applications, working safely with machines, etc.	

	Students can use virtual reality to become familiar with dangerous situations in machining operations, when setting up machines, to learn designs and techniques, to make design decisions and to collect data based on material condition.	
Objective 28	**The students digitally create a production plan and work preparation.** Automated production process It can be about flowchart, efficient production flow (connected machines), planning model and order planning. Use BIM (Building Information Model) as a tool to work more efficiently and error-free. A model as a means of communication between different parties in the production process.	
Objective 29	**The students digitally optimize data and materials, calculate material quantities and prepare separate material statements.** The students use a professional optimization program to optimize panel materials and solid wood. This concerns aspects such as thread direction, edge bands, detecting errors, re-optimizing residual pieces, labeling, etc.	
Objective 32	**The students draw up a machining program and control CNC-controlled woodworking machines.** CNC programs: generation, CAD-CAM, programming language.	
Objective 33	**The students detect programming errors in CNC programs and adjust the program.**	
Objective 34	**The students optimize CNC programs based on efficiency, service life of the cutting tools and material consumption.**	
Objective 52	**The students process parts with CNC-controlled woodworking machines.**	
Objective 57	**The students record and report the progress of the production process.**	

Table 3: EQF 4 - Wood Techniques: AAL skills and knowledge already included in the objectives

OBJECTIVES	AAL skills and knowledge already included in the objectives	AAL skills and knowledge suggested in »Pathways to HE«
Objective 19	**The students illustrate the interaction between science, technology, mathematics and society on the basis of social challenges.** AAL can pose a social challenge as a basis for	• Smart buildings • Smart furniture • Ergonomic interior design

	conducting research. Responds to the need of the elderly to remain functional for longer. This could include height-adjustable furniture, for example an adjustable worktop. Chairs that are ergonomically better than "commercial products". Beds... This can be seen in terms of CNC challenges.	• Sensors • Fire and other safety
Objective 36	The students adopt an ergonomic posture and avoid physical loads and ergonomic bottlenecks when preparing and carrying out work. Comparing the body posture (static, dynamic) of a fellow student with a reference image is a first step in becoming aware of one's own posture. You can teach students how to use ergonomic aids such as an exoskeleton, lifting equipment for sheet materials on panel and section sawing machines. The students show that the use of an exoskeleton is not only for work situations. An exoskeleton is also a welcome aid for less mobile people and the elderly. You can let students experience back training to learn the correct techniques of lifting, hoisting and moving.	

4. A PROPOSAL TO COMPLEMENT WOOD TECHNIQUES AT EQF 4 LEVEL WITH CIRCULAR ECONOMY, INDUSTRY 4.0 AND AAL SKILLS AND KNOWLEDGE IN THE WOOD AND FURNITURE SECTOR

The curriculum has recently been completely renewed and is used for the first time this school year 2023-2024. So at the moment the curriculum is up to date, but this is of course being further developed.

EQF 4 -WOOD TECHNIQUES: CIRCULAR ECONOMY Is up to date but this is of course being further developed.

EQF 4 -WOOD TECHNIQUES: INDUSTRY 4.0 Is up to date but this is of course being further developed.

EQF 4 -WOOD TECHNIQUES: AAL Is up to date but this is of course being further developed.

CASE STUDY: FRANCE

1. BODIES INVOLVED IN THE PROCESS OF UPDATING QUALIFICATIONS AND KEY DOCUMENTS FOR THE DESIGN OF QUALIFICATIONS

FCBA offers training courses for furniture professionals and students, with an emphasis on materials and ergonomics. We are not a dedicated training centre, but we do offer one-off training courses. We are attached to a training centre (Qualiopi) which validates our training courses.
The training courses offered by the FCBA Institute of Technology are updated by the experts who provide them. The experts are in close contact with the institutions responsible for regulations and qualifications. These courses are designed for professionals or for students with a level corresponding to EQF 6, EQF 7, EQF 8.
There are also other institutions, such as the AFPIA, les Compagnons du Devoir, apart from universities, which provide training for the wood sector in which the FCBA is involved. These courses are validated by a certificate awarded by the training institution. These courses are designed for professionals or for students with a level corresponding to EQF 4, EQF 5, EQF 6, EQF 7.

2. QUALIFICATIONS IN THE WOOD AND FURNITURE SECTOR AT EQF 4 AND EQF 5 LEVEL

Several courses are offered depending on the student's background, or the last year of secondary school if the student chooses a more technical course. The French career guidance system has just changed, offering students a choice of economic, literary, and scientific courses.

EQF 4

- Bachelor pro Wood construction technician:

Holders of the Wood Construction Technician vocational bachelor work in craft or industrial companies that manufacture and install structural, framing and carpentry work in wood and derived products in the building, housing and environment sectors (housing, business premises, premises open to the public, urban development, outdoor development). They work partly in the workshop, carrying out manufacturing operations, and partly on site, carrying out lifting and installation operations.

- Bachelor pro Wood and associated materials manufacturing technician:

The holder of the vocational bachelor in wood and associated materials manufacturing is a workshop technician who works in joinery and furniture companies, producing small or medium-sized series of works in wood and associated materials. They take part in organisational activities and master product or component manufacturing techniques.

Within the company, his activity consists of :
- preparing for the manufacture of joinery and furniture;
- manufacturing and packaging the products
- monitoring and checking production;
- taking part in equipment maintenance.

- Bachelor pro Sawmill technician
- Bachelor pro Joinery and fittings technician
- Bachelor techno STI2D Sciences and technologies for industry and development

EQF 5

- With the BTS in wood development and production, is possible to work in a sawmill or in a furniture or fittings company, and take up positions as line or numerically-controlled machine operator, furniture and joinery manufacturing technician, or wood production team leader.
- The BTS SCBH leads to jobs as site manager, design office technician, carpentry, flooring or joinery technician, works supervisor, etc.
- A BTSA in forestry management will enable you to work for an association, a group of forest owners or a development organisation as a senior forestry technician, research and promotion manager or forestry and wood product manager.
- The holder of a BTSA (advanced vocational diploma) in technical sales canvasses for wood lots, estimates their value and negotiates selling prices before organising felling and transport. Your job? Technical sales representative in the timber industry.

EQF 4: WOOD TECHNICIAN

Occupational competences

The candidate is able to:

- plan and organise work in wood production,
- organise workplaces and transport in the production process,
- operate and set up woodworking machinery and equipment and processing lines
- prepare plans and documentation for the manufacture of products
- plan and carry out technological and operational work preparation
- use modern information and communication technology in their work
- use entrepreneurial skills
- find, compare and use different sources of information

EQF 5: BTS IN WOOD DEVELOPMENT AND PRODUCTION

Occupational competences:

The candidate is able to:

- plan and organise the performance of work tasks
- organise and manage production processes in the woodworking industry effectively
- introduce technological and organisational innovations into technological processes
- work in teams to develop products or technological processes,
- collaborate with experts in the preparation of investment project documentation
- analyse data and propose technical solutions,
- manage production resources economically and be entrepreneurial in business processes,
- use modern information and communication technology,
- keep abreast of developments in the wider professional field,
- ensure the strict implementation of occupational health and safety and environmental protection regulations

3. CIRCULAR ECONOMY, INDUSTRY 4.0 AND AMBIENT AND ASSISTED LIVING (AAL) SKILLS AND KNOWLEDGE THAT ARE ALREADY INCLUDED IN THE EXSISTED MODULES COMPARED TO THE PROPOSALS IN »PATHWAYS TO HE«

EQF 4 - WOOD TECHNICIAN

There are several programmes for training to become a Professional Joinery Fitter Technician. We've taken an example of one of the many existing programmes to give a general idea of what the training consists of.

Table 1: EQF 4 - Wood Technician: Comparison of the Circular Economy skills and knowledge already included in the modules with those proposed in Pathways to HE.

Module	Circular Economy skills and knowledge already included in the modules	Circular Economy skills and knowledge suggested in »Pathways to HE«
REALISATION 1 - Initiation & Implementation 2- Furniture 3- Layout 4- Methods 5- Shaping machines	1. Creation of a pocket shelf Installation of a panelled underframe Installation of a pocket 2. Cutting and grinding Layout and tracing Shaping Assembly and finishing 3. Cutting & sizing Edge banding Shaping Cabinet assembly Laminated door veneer Fitting Installation 4. Flow tracing Establishment signs Machining tracings Assembling and finishing work 5. The sliding table saw Tenoning machine Wick mortiser Chisel mortiser Vertical spindle moulder	• Eco Design • Cascading use • Natural resources management • Renewable energy sources • Efficient and sustainable productions • Environmental effects • Circular business models • Industry symbioses • System thinking implementation • Biorefinery • Green chemicals • Bio economy • Functional materials (sustainable composites, advanced materials) • LCA analyses • Collection and recycling • Transparency in supply chains • Hazardous chemicals • Green public procurement • Nano technology
TECHNOLOGIE Processing technology with occupational safety 1-The machines 2-Cutting and grinding machines 3-Construction 4-The works 5-Methods 6-The products	1. Machine tool analogy 2. Radial and cross-cut circular saws Circular edging saw Band saws Surface planer Planing machines 3. Plan reading Sectioning 4. Connections and assemblies Profiles 5. Cut sheet / bill of materials	

7-Use of wood	The manufacturing processes Manufacturing analysis 6. Adhesives Finishing products 7. Areas of use Wood deterioration Preservatives Drying	
CO-INTER French 1-Training 2-The tree 3-Materials & products 4-Properties of wood 5-Projects & Company	1. Mind map 2. Botanical & Origin Classification The Tree Visit a forest 3. Cutting timber Visit a sawmill 4. Wood identity sheet Defects Alterations and parasites 5. Types and composition of structures Interior joinery (doors, staircases, fittings, etc.) External joinery (doors, windows, shutters, etc.)	
CO-INTER Math 1-Properties of wood 2-Construction of structures 3-The materials 4-Methods 5-Cutting technology	1. Physiognomic properties & Density Mechanical properties & stresses Physical properties Rates & percentages 2. Types of drawings Views Scales & Formats Title block Lines Reading a plan Creating a technical drawing Drawing a section 3. Derivative panels & coatings and Bending curve for panels 4. Cutting sheet / bill of materials Layout drawing 5. Principle of generation Machining The cutting tool Cutting kinematics	

Table 2: EQF 4 - Wood Technician: Comparison of the Industry 4.0 skills and knowledge already included in the modules with those proposed in Pathways to HE

Module	Industry 4.0 skills and knowledge already included in the modules	Industry 4.0 skills and knowledge suggested in »Pathways to HE«
Technical communication and computer use	Students understand the basic principles of ICT and how to use it. The student is familiar with the software, hardware and technical equipment used to carry out various work tasks. The student is familiar with basic operating systems and their functions. Uses computer programs to draw drawings and plans.	• Cross reality (VR, AR, MR) • Cloud computing • Online security • Internet of things (IoT) • Simulations • Autonomous (smart) robots • Big data • Additive productions -3D, 4D printing • Artificial intelligence
Company and work preparation	Use of information and communication technology.	
Design	Use information communication technology (3D drawing, activity planner, presentation software, etc.).	

Table 3: EQF 4 - Wood Technician: Comparison of the AAL skills and knowledge already included in the modules with those proposed in Pathways to HE

MODULE	AAL skills and knowledge already included in the modules	AAL skills and knowledge suggested in »Pathways to HE«
Furniture construction	Understands the influence of ergonomics on the design of seating furniture.	• Smart buildings • Smart furniture • Ergonomic interior design • Sensors • Fire and other safety
Interior furnishing - optional course	Knows the anthropometric data and ergonomic dimensions of furniture.	
Processing technology with occupational safety	They learn about fire safety and environmental protection.	

Table: 4: EQF 5 – Wood science and technology engineer: Comparison of the Circular economy skills and knowledge already included in the modules with those proposed in Pathways to HE

Bachelor science and engineering: 3 years post-baccalaureate course to build a sustainable future with wood and other bio-based materials. ESB's Bachelor's degree in Science and Engineering provides 3-year training for professionals in developing sustainable technical solutions for the industry and buildings of the future.
During their course, students will develop the scientific and technical skills needed to manage low environmental impact projects using bio-based materials (wood, straw, hemp, etc.).
They will become real players in environmental transformation through the assignments you will be given in companies.
The ESB Bachelor of Science and Engineering is based on a core curriculum and specific core curriculum and specific chosen path.

Module	Circular Economy skills and knowledge already included in the modules	Circular Economy skills and knowledge suggested in »Pathways to HE«
Common courses	- Scientific subjects and engineering - Science of wood and other bio-based materials - Business management - Human and social sciences	• Natural resources management • Renewable energy sources • Efficient and sustainable productions • Environmental effects • Circular business models • Industry symbioses • System thinking implementation • Biorefinery • Green chemicals • Bio economy • Functional materials (sustainable composites, advanced materials) • LCA analyses • Collection and recycling • Transperancy in supply chains • Hazardous chemicals • Green public procurement • Nano technology
INDUSTRIAL ENGINEERING	This course trains production managers in the wood processing industries industries, capable of managing complex complex tools. These professionals support companies in the digital digital transformation of production based on based on the Industry 4.0 model.	
On completion of the course, students will be able to be able to :	- design works such as objects furniture, fittings, etc. - program numerically controlled machines, - draw up production monitoring monitoring dashboards, - optimise production management and logistics flows, - carry out first-level maintenance, - managing a team of production operators.	
Courses specific to the pathway	- 2D/3D design - Industrial management and automation - Production organisation	
CONSTRUCTION SITE MANAGEMENT	This course trains site supervisors using bio-sourced materials (wood, straw, hemp, etc.). These professionals support construction companies who are keen to reduce the environmental impact of their activities on the environment.	

Table 5: EQF 5 – Wood technology engineer: Comparison of the Industry 4.0 skills and knowledge already included in the modules with those proposed in pathways to HE

Module	Industry 4.0 skills and knowledge already included in the modules	Circular Economy skills and knowledge suggested in »Pathways to HE«
On completion of the course, students will be able to be able to :	Identify the technical solutions to be implemented at the design stage of a project,	• Cloud computing • Online security • Internet of things (IoT)

	- choose solutions and/or technologies that have impact on the environment, - set up a worksite, taking into account the constraints of each trade, - monitor the progress of a project using using project management tools, - ensure that the chosen solutions are solutions,	• Simulations • Autonomous (smart) robots • Big data • Additive productions -3D, 4D printing • Artificial intelligence
Courses specific to the pathway	- Eco-design of buildings - Building science - Site organisation and monitoring	
TECHNICAL SALES	This pathway trains business managers who contribute to the implementation of solutions for the construction of low-impact low environmental impact buildings and environmental impact. They can also work in in related sectors such as energy and and packaging.	
On completion of the course, students will be able to be able to :	Developing technically and economically appropriate from: - a technical and economic point of view to customers companies (B to B) or individuals (B to C), - source the various materials required for the project, - buying and/or selling these solutions.	
Courses specific to the pathway	-Technical and economic design of a commercial offer - Customer relationship management - Sourcing / purchasing	

Table 6: EQF 5 - Wood technology engineer*:* Comparison of the AAL skills and knowledge already included in the modules with those proposed in Pathways to HE

Module	AAL skills and knowledge already included in the modules	AAL skills and knowledge suggested in »Pathways to HE«
/	/	• Smart buildings • Smart furniture • Ergonomic interior design • Sensors • Fire and other safety
/	/	
/	/	

4. A PROPOSAL TO COMPLEMENT EXISTING QUALIFICATIONS WITH CIRCULAR ECONOMY, INDUSTRY 4.0 AND AAL SKILLS AND KNOWLEDGE AT EQF 4 AND EQF 5 LEVEL IN THE WOOD AND FURNITURE SECTOR

Based on the review presented in the tables above, we have concluded that some Circular economy, Industry 4.0 and AAL skills and knowledge are missing and should be updated in the existing qualifications. While our list is not exhaustive, it highlights the urgent need to integrate sustainable and digital skills and knowledge into VET educational and training programmes. These identified gaps are crucial for adapting our qualifications to the evolving needs of the modern workforce and expectations. By integrating these skills and knowledge, we aim to improve the relevance and applicability of our VET programmes, equipping learners with the essential skills they need to thrive in a rapidly changing global environment, particularly in the specialised wood and furniture sector:

EQF 4 -WOOD TECNITIAN: CIRCULAR ECONOMY

- Cascading use
- Efficient and sustainable productions
- Circular business models
- Industry symbioses
- System thinking implementation
- Bio economy
- Functional materials (sustainable composites, advanced materials)
- Transparency in supply chains
- Green public procurement

EQF 4 -WOOD TECHNITIAN: INDUSTRY 4.0

- Online security
- Internet of things (IoT)
- Autonomous (smart) robots
- Big data
- Artificial intelligence

EQF 4 -WOOD TECHNITIAN: AAL

- Sensors

EQF 5 -WOOD SCIENCE TECHNOLOGY ENGINEER: CIRCULAR ECONOMY

- Cascading use
- Circular business models
- Industry symbioses
- Bioeconomy
- Green public procurement

EQF 5 -WOOD TECHNOLOGY ENGINEER: INDUSTRY 4.0

- Internet of things (IoT)
- Autonomous (smart) robots
- Artificial intelligence

EQF 5 -WOOD TECHNOLOGY ENGINEER: AAL

- Smart furniture

CASE STUDY: GERMANY

1. BODIES INVOLVED IN THE PROCESS OF UPDATING QUALIFICATIONS AND KEY DOCUMENTS FOR THE DESIGN OF QUALIFICATIONS

Several bodies and organizations typically play vital roles in the process of updating qualifications and key documents related to designing qualifications. These entities collaborate to ensure that qualifications remain relevant, responsive to industry needs, and aligned with educational standards. Collaboration and consultation among these entities ensure that qualifications are updated to meet the demands of changing industries, technological advancements, and societal needs while maintaining quality and relevance in vocational training and education. In Germany the Ministry of Economy is in charge to update qualifications. The updating process can be started by associations, trade unions, chambers or companies. They work together with the Board of Trustees of the German Industry for Vocational Training (KWB). After starting the update process the KWB will initiate an expert panel from companies, schools and organizations. This panel is in charge to work out the updates and present the results to the Ministry of economics, which will publish the new training regulations.

2. QUALIFICATIONS IN THE WOOD AND FURNITURE SECTOR AT EQF 4 AND EQF 5 LEVEL

Qualifications in the wood and furniture sector in Germany at the European Qualifications Framework (EQF) Level 4 and Level 5 generally align with specific vocational training, interships and higher educational qualifications. The EQF provides a common European reference framework to understand qualifications and their levels across different countries.

EQF 4

Vocational Training and Apprenticeships:

- At EQF Level 4, individuals might undergo vocational training programs specializing in woodworking, carpentry, or furniture making.
- Apprenticeships in woodworking and furniture production typically last around 3 years in Germany, combining practical on-the-job training with theoretical knowledge gained in vocational schools.
- Qualifications at this level focus on developing practical skills in woodworking techniques, furniture assembly, material handling, basic design principles, and machinery operation.

EQF 5

1. Advanced Vocational Training or Technical Specialist Qualifications:
    - EQF Level 5 qualifications in the wood and furniture sector might include advanced vocational training or specialized technical qualifications.
    - Individuals who have completed their initial vocational training and gained practical experience might pursue further education to specialize in areas like furniture design, production management, or technical aspects of woodworking.
    - Advanced vocational programs at this level could focus on CNC (Computer Numerical Control) machining, specialized furniture construction, product design, quality control, or business administration related to the wood and furniture industry.
2. Higher Education Programs:

- Some bachelor's degree programs in Germany, particularly in technical fields like wood technology, furniture design, or industrial engineering with a focus on wood and furniture manufacturing, might align with EQF Level 5.
- These programs offer a more comprehensive and theoretical approach, combining technical knowledge with management skills and innovation in the wood and furniture sector.

It's important to note that EQF levels provide a reference point but may not directly map onto specific qualifications in every country. The exact structure and qualifications may vary between educational institutions and regions within Germany.

For the purpose of this task, we have selected qualification Wood technician at EQF level 4 and qualification Wood technology engineer at EQF level 5 that should be updated with skills and knowledge on Circular economy, Industry 4.0 and AAL.

EQF 4: WOOD TECHNICIAN

Occupational competences:

1. Woodworking Techniques:
   - Proficiency in various woodworking techniques such as sawing, planing, routing, and sanding.
   - Knowledge of joinery, assembly, and finishing processes for different wood products.
2. Material Knowledge and Selection:
   - Understanding the properties of different types of wood, veneers, laminates, and engineered wood products.
   - Knowledge of wood characteristics and suitable applications for different purposes.
3. Machinery Operation and Maintenance:
   - Competence in operating and maintaining woodworking machinery and equipment, including saws, drills, CNC machines, and sanders.
   - Ensuring safety protocols and adherence to maintenance schedules for machinery.
4. Quality Control and Assurance:
   - Ability to inspect and evaluate wood materials, components, and finished products for quality standards and defects.
   - Implementing quality control measures throughout the production process.
5. Technical Drawing and Interpretation:
   - Proficiency in reading and interpreting technical drawings, blueprints, and design specifications related to woodworking projects.
   - Translating designs into practical woodworking processes and assemblies.
6. Process Optimization and Efficiency:
   - Identifying opportunities for process improvements, efficiency enhancements, and cost reduction within wood manufacturing processes.
   - Implementing best practices for optimizing production workflows.
7. Health and Safety Compliance:
   - Adherence to health and safety regulations and practices in the woodworking environment.
   - Ensuring a safe working environment for oneself and others while handling tools and machinery.

8. Communication and Collaboration:
    - Effective communication and collaboration within the team, including coordination with colleagues, supervisors, and clients.
    - Ability to follow instructions and work cohesively in a team environment.

EQF 5: WOOD TECHNOLOGY ENGINEER

Occupational competences:

1. Advanced Wood Processing Techniques:
    - Mastery of advanced woodworking and timber processing techniques, including precision cutting, shaping, milling, and finishing.
    - Expertise in innovative wood processing methods and technologies.
2. Materials Science and Engineering:
    - In-depth knowledge of wood properties, wood anatomy, timber behavior, and the characteristics of different wood species.
    - Understanding wood-based materials, composites, and their applications.
3. Technical Design and CAD/CAM Skills:
    - Proficiency in computer-aided design (CAD) and computer-aided manufacturing (CAM) software for designing and modeling wood products and components.
    - Ability to create detailed technical drawings and specifications for woodworking projects.
4. Process Optimization and Innovation:
    - Identifying and implementing innovative technologies and techniques for process optimization, cost-efficiency, and sustainability in wood manufacturing.
    - Developing and improving manufacturing processes to enhance productivity and product quality.
5. Quality Management and Assurance:
    - Oversight of quality control measures throughout the wood production process, ensuring adherence to strict quality standards and regulations.
    - Implementing quality management systems and continuous improvement initiatives.
6. Project Management and Leadership:
    - Skills in project planning, scheduling, and coordination within the wood production environment.
    - Leadership abilities to manage teams, assign tasks, and ensure project goals are met effectively.
7. Environmental Sustainability and Circular Economy:
    - Understanding and promoting sustainable practices, including resource management, waste reduction, and the principles of circular economy in wood manufacturing.
    - Implementing environmentally friendly practices within wood production processes.
8. Regulatory Compliance and Health & Safety:
    - Ensuring compliance with industry regulations, standards, and health & safety protocols within the wood industry.
    - Creating and maintaining a safe working environment for employees.
9. Research and Development (R&D):

- Engaging in research activities to explore new materials, technologies, and innovations in wood processing and manufacturing.
- Contributing to advancements and improvements in the field through R&D initiatives.

3. CIRCULAR ECONOMY, INDUSTRY 4.0 AND AMBIENT AND ASSISTED LIVING (AAL) SKILLS AND KNOWLEDGE THAT ARE ALREADY INCLUDED IN THE EXSISTED MODULES COMPARED TO THE PROPOSALS IN »PATHWAYS TO HE«

Procedure

Firstly, we reviewed the modules included in Wood Technician and Wood Technology Engineer qualifications and then identified the skills and knowledge related to the Circular Economy, Industry 4.0 and AAL that are already included in the modules. These skills and knowledge were compared with those proposed in the Pathways to HE report. The results of the comparison are presented in the tables below. Skills and knowledge already included in the modules are highlighted in green and underlined.

EQF 4 - WOOD TECHNICIAN

Table 1: EQF 4 - Wood Technician: Comparison of the Circular Economy skills and knowledge already included in the modules with those proposed in Pathways to HE.

Module	Circular Economy skills and knowledge already included in the modules	Circular Economy skills and knowledge suggested in »Pathways to HE«
Woodworking Techniques and Processes	Emphasis on sustainable wood sourcing, recycling, and the use of reclaimed or repurposed wood materials in practical exercises or projects.	• Eco Design • Cascading use • Natural resources management • Renewable energy sources • Efficient and sustainable productions • Environmental effects • Circular business models • Industry symbioses • System thinking implementation • Biorefinery • Green chemicals • Bio economy • Functional materials (sustainable composites,
Material Science and Properties of Wood	Understanding the lifecycle of wood products, including discussions on recycling, upcycling, and designing products for easy disassembly and reuse.	
Machinery Operation and Maintenance	Training on efficient use of machinery to minimize waste, repair techniques to extend machinery lifespan, and discussions on how efficient production contributes to reducing environmental impact.	
Quality Control and Assurance	Teaching methods to repurpose or reuse wood waste, implementing quality standards that promote using sustainable materials, and discussing how product quality impacts reusability or recyclability.	
Technical Drawing and Design Principles	Encouraging sustainable design practices, such as modular designs for easy repair, disassembly, or recycling, and considering material choices based on their environmental impact.	

Woodworking machinery	Develops eco-consciousness of energy consumption in woodworking machinery	advanced materials) • LCA analyses • Collection and recycling • Transparency in supply chains • Hazardous chemicals • Green public procurement • Nano technology
Health and Safety Practices	Integrating safety measures related to handling recycled or reclaimed materials, emphasizing safe disposal methods, and discussing health hazards related to specific wood treatments or finishes.	
Environmental Sustainability and Regulations	Covering environmental regulations, waste management laws, and discussions on how adherence to Circular Economy principles aligns with sustainability laws and policies.	
Project Work and Practical Experience	Encouraging projects that involve recycling, upcycling, or designing products with a focus on sustainability, along with analysing the environmental impact of various production methods.	

Table 2: EQF 4 - Wood Technician: Comparison of the Industry 4.0 skills and knowledge already included in the modules with those proposed in Pathways to HE

Module	Industry 4.0 skills and knowledge already included in the modules	Industry 4.0 skills and knowledge suggested in »Pathways to HE«
Woodworking Techniques and Processes	Introduction to digital manufacturing technologies like CNC machines, robotics, and automated woodworking systems used in modern wood manufacturing processes.	• Cross reality (VR, AR, MR) • Cloud computing • Online security • Internet of things (IoT) • Simulations • Autonomous (smart) robots • Big data • Additive productions - 3D, 4D printing • Artificial intelligence
Material Science and Properties of Wood	Understanding advanced materials and technologies used in wood processing, such as smart materials or sensor-based technologies for quality control.	
Machinery Operation and Maintenance	Training on operating and programming computer-controlled machinery, IoT (Internet of Things) applications, and maintenance of digitally integrated equipment.	
Quality Control and Assurance	Introduction to data-driven quality control systems, using sensors and data analytics to monitor and optimize production processes for quality assurance.	
Technical Drawing and Design Principles	Incorporating CAD (Computer-Aided Design) software for creating and modifying technical drawings, enabling the integration of digital design with manufacturing.	
Health and Safety Practices	Understanding safety protocols related to the operation of advanced machinery and robotics in wood manufacturing, emphasizing human-machine safety interfaces.	

Environmental Sustainability and Regulations	Exploring how Industry 4.0 technologies can contribute to sustainable manufacturing practices, such as energy-efficient production and waste reduction through smart processes.	
Project Work and Practical Experience	Encouraging projects that involve the implementation of digital technologies in wood manufacturing, providing hands-on experience with automated systems.	

Table 3: EQF 4 - Wood Technician: Comparison of the AAL skills and knowledge already included in the modules with those proposed in Pathways to HE

MODULE	AAL skills and knowledge already included in the modules	AAL skills and knowledge suggested in »Pathways to HE«
Woodworking Techniques and Processes	Understanding ergonomic design principles might indirectly relate to AAL by considering accessibility and user-friendly design in furniture or wood products.	• Smart buildings • Smart furniture • Ergonomic interior design • Sensors • Fire and other safety
Material Science and Properties of Wood	Knowledge of materials and their properties could contribute to creating furniture that aligns with AAL principles, such as using lightweight, durable, or adaptable materials.	
Machinery Operation and Maintenance	Knowledge of precision machinery and techniques could indirectly apply to crafting furniture or products designed for individuals with mobility or accessibility needs.	
Quality Control and Assurance	Attention to detail and quality in wood manufacturing could contribute to creating reliable and safe furniture or wooden structures supporting AAL technologies	
Technical Drawing and Design Principles	Understanding design considerations might indirectly contribute to creating furniture that integrates AAL technologies or accommodates assistive devices.	
Project Work and Practical Experience	Encouraging project work might foster creativity in designing furniture or woodworking projects that align with AAL principles, even if not explicitly stated in the curriculum.	

Table: 4: EQF 5 – Wood technology engineer: Comparison of the Circular economy skills and knowledge already included in the modules with those proposed in Pathways to HE

Module	Circular Economy skills and knowledge already included in the modules	Circular Economy skills and knowledge suggested in »Pathways to HE«

Materials Science and Technology	Understanding sustainable materials, eco-friendly wood treatment methods, and exploring innovative materials or composites with lower environmental impact.	• Natural resources management • Renewable energy sources • Efficient and sustainable productions • Environmental effects • Circular business models • Industry symbioses • System thinking implementation • Biorefinery • Green chemicals • Bio economy • Functional materials (sustainable composites, advanced materials) • LCA analyses • Collection and recycling • Transperancy in supply chains • Hazardous chemicals • Green public procurement • Nano technology
Process Optimization and Innovation	Focusing on sustainable production methods, waste reduction strategies, and exploring innovative techniques that align with Circular Economy principles.	
Environmental Sustainability and Regulations	Covering environmental laws, regulations, and sustainability standards related to wood processing, emphasizing compliance with Circular Economy principles.	
Quality Management and Assurance	Implementing quality control measures that emphasize sustainability, recycling, or repurposing of materials, aligning with Circular Economy practices.	
Project Management and Leadership Life Cycle Assessment (LCA) Analyses	Encouraging leadership in projects promoting eco-design, sustainable manufacturing, or Circular Economy initiatives within wood technology projects. Learning to conduct LCA analyses to evaluate the environmental impact of wood products and processes, aligning with Circular Economy principles.	

Table 5: EQF 5 – Wood technology engineer: Comparison of the Industry 4.0 skills and knowledge already included in the modules with those proposed in pathways to HE

Module	Industry 4.0 skills and knowledge already included in the modules	Circular Economy skills and knowledge suggested in »Pathways to HE«
Manufacturing Processes and Automation	Understanding modern manufacturing techniques, including CNC (Computer Numerical Control) machinery and automation, might be included in modules related to advanced manufacturing processes.	• Cloud computing • Online security • Internet of things (IoT) • Simulations • Autonomous (smart) robots • Big data • Additive productions - 3D, 4D printing • Artificial intelligence
Materials Science and Technology	Learning about advanced materials, such as smart or composite materials, might indirectly relate to Industry 4.0 applications in material sciences.	

Digital Design and CAD/CAM Software	Training in computer-aided design (CAD) and computer-aided manufacturing (CAM) software for digital modeling and process planning might be integrated.	
Process Optimization and Innovation	Modules might cover principles of optimizing production processes, which could include aspects of lean manufacturing or digital process optimization aligned with Industry 4.0.	
Quality Control and Assurance	Knowledge of quality management systems and potentially incorporating data-driven quality control methods aligning with Industry 4.0 principles.	
IoT and Sensors in Manufacturing	Depending on the specialization or elective modules, there might be some exposure to the concept of IoT and sensor applications in advanced manufacturing environments.	
Digitalization and Smart Technologies	Introduction to the digitalization of manufacturing processes and the integration of smart technologies might be covered to some extent.	

Table 6: EQF 5 - Wood technology engineer: Comparison of the AAL skills and knowledge already included in the modules with those proposed in Pathways to HE

Module	AAL skills and knowledge already included in the modules	AAL skills and knowledge suggested in »Pathways to HE«
Materials Science and Technology	Understanding materials used in furniture production might indirectly relate to AAL by considering factors such as durability, adaptability, and usability for individuals with specific needs.	• Smart buildings • Smart furniture • Ergonomic interior design • Sensors • Fire and other safety
Design Principles and Ergonomics	Knowledge of design principles might encompass aspects of user-centric design and considerations for comfort, usability, and accessibility in furniture or product design.	
Manufacturing Processes and Automation	Knowledge of manufacturing techniques might indirectly apply to producing furniture or products designed for individuals with specific requirements, considering customization and adaptability.	

Quality Control and Assurance	Emphasizing quality in wood manufacturing might contribute to creating reliable and safe furniture or wooden structures supporting AAL technologies.	
Health and Safety Practices	Safety protocols in woodworking might indirectly align with creating safe living environments, including considerations for safety in furniture production.	

4. A PROPOSAL TO COMPLEMENT EXISTING QUALIFICATIONS WITH CIRCULAR ECONOMY, INDUSTRY 4.0 AND AAL SKILLS AND KNOWLEDGE AT EQF 4 AND EQF 5 LEVEL IN THE WOOD AND FURNITURE SECTOR

Based on the review presented in the tables above, we have concluded that some Circular economy, Industry 4.0 and AAL skills and knowledge are missing and should be updated in the existing qualifications. While our list is not exhaustive, it highlights the urgent need to integrate sustainable and digital skills and knowledge into VET educational and training programmes. These identified gaps are crucial for adapting our qualifications to the evolving needs of the modern workforce and expectations. By integrating these skills and knowledge, we aim to improve the relevance and applicability of our VET programmes, equipping learners with the essential skills they need to thrive in a rapidly changing global environment, particularly in the specialised wood and furniture sector:

EQF 4 -WOOD Technician: CIRCULAR ECONOMY

- Cascading use
- Circular business models
- Industry symbioses
- Biorefinery
- Green chemicals
- Bio economy
- Nano technology

EQF 4 -WOOD Technician: INDUSTRY 4.0

- Online security

EQF 5 -WOOD TECHNOLOGY ENGINEER: CIRCULAR ECONOMY

- Cascading use
- Industry symbioses
- Biorefinery
- Green chemicals
- Bio economy
- Nano technology

EQF 5 -WOOD TECHNOLOGY ENGINEER: AAL

- Smart furniture

CASE STUDY: SLOVENIA

1. BODIES INVOLVED IN THE PROCESS OF UPDATING QUALIFICATIONS AND KEY DOCUMENTS FOR THE DESIGN OF QUALIFICATIONS

Vocational education and training (VET) programmes are based on one or more occupational standards that are developed through social dialogue within the sector. Occupational standard defines the expected knowledge, skills and competences that a qualification holder must possess at a certain level of proficiency. In the wood and furniture sector proposals for updating the occupational standards are forwarded to the Sectoral Committees for production technology, which approve new or revised content. Once approved by the Sector Committee, the VET programme is updated in accordance with the changes in occupational standards. The VET programmes are competence-based and modularised. For each vocational module, a catalogue of knowledge is prepared at national level.

2. QUALIFICATIONS IN THE WOOD AND FURNITURE SECTOR AT EQF 4 AND EQF 5 LEVEL

The vocational education and training system in Slovenia is based on the national level. There are 2 qualifications corresponding to EQF 4 and one qualification corresponds to EQF 5 in the wood and furniture sector.

EQF 4

- CARPENTER
- WOOD TECHNITIAN

EQF 5

- WOOD TECHNOLOGY ENGINEER

For the purpose of this task, we have selected qualification Wood technician at EQF level 4 and qualification Wood technology engineer at EQF level 5 that should be updated with skills and knowledge on Circular economy, Industry 4.0 and AAL.

EQF 4: WOOD TECHNICIAN

Occupational competences

The candidate is able to:

- plan and organise work in wood production,
- organise workplaces and transport in the production process,
- select the wood, wood-based materials and work materials for a product of a given quality,
- operate and set up woodworking machinery and equipment and processing lines,
- prepare plans and documentation for the manufacture of products,
- plan and carry out technological and operational work preparation,
- process data on production parameters and introduce innovations in the production process,

- ensure the quality of products and services provided,
- use modern information and communication technology in their work,
- use time, energy and materials economically,
- work in a way that protects the environment and does not endanger health and safety at work,
- communicate with the various stakeholders in their work,
- use entrepreneurial skills
- find, compare and use different sources of information.

EQF 5: WOOD TECHNOLOGY ENGINEER
Occupational competences:
The candidate is able to:

- plan and organise the performance of work tasks rationally,
- rationally plan modern technological processes in the woodworking industry and plan the modernisation of existing ones,
- organise and manage production processes in the woodworking industry effectively,
- successfully introduce technological and organisational innovations into technological processes,
- work in teams to develop products or technological processes,
- collaborate with experts in the preparation of investment project documentation,
- setting up systems for monitoring the production process, quality and maintenance,
- analyse data and propose technical solutions,
- provide expert advice to various stakeholders in the refurbishment of wood products and the furnishing of premises,
- manage production resources economically and be entrepreneurial in business processes,
- use modern information and communication technology,
- keep abreast of developments in the wider professional field,
- ensure the strict implementation of occupational health and safety and environmental protection regulations
- communicate with different stakeholders.

3. CIRCULAR ECONOMY, INDUSTRY 4.0 AND AMBIENT AND ASSISTED LIVING (AAL) SKILLS AND KNOWLEDGE THAT ARE ALREADY INCLUDED IN THE EXSISTED MODULES COMPARED TO THE PROPOSALS IN »PATHWAYS TO HE«

Procedure

Firstly, we reviewed the modules included in Wood Technician and Wood Technology Engineer qualifications and then identified the skills and knowledge related to the Circular Economy, Industry 4.0 and AAL that are already included in the modules. These skills and knowledge were compared with those proposed in the Pathways to HE report. The results of the comparison are presented in the tables below. Skills and knowledge already included in the modules are highlighted in green and underlined.

EQF 4 - WOOD TECHNICIAN

Table 1: EQF 4 - Wood Technician: Comparison of the Circular Economy skills and knowledge already included in the modules with those proposed in Pathways to HE.

Module	Circular Economy skills and knowledge already included in the modules	Circular Economy skills and knowledge suggested in »Pathways to HE«
Wood and wood properties	Students make connections between the causes of forest dieback and the consequences of threats. The student learns about the legal requirements for environmental protection in the field of forestry. The student learns about wood protection procedures including ecological aspects. Critically reflects on hazardous waste in the timber industry. Develops a sense of responsibility towards a healthy environment.	• Eco Design • Cascading use • Natural resources management • Renewable energy sources • Efficient and sustainable productions • Environmental effects • Circular business models • Industry symbioses • System thinking implementation • Biorefinery • Green chemicals • Bio economy • Functional materials (sustainable composites, advanced materials) • LCA analyses • Collection and recycling • Transparency in supply chains • Hazardous chemicals • Green public procurement • Nano technology
Processing technology with occupational safety	Students learn about occupational safety, fire safety and environmental protection. The student learns about what *ecology researches and studies, lists some of the consequences of the development of technology that are harmful to the human environment, handles waste properly, lists possible environmental pollutants in wood processing and measures to reduce the harmful effects on the environment. Learn about surface treatment of wood, in particular special techniques and bio-surface treatment of wood.	
Materials in woodworking	Critically reflects on the ecological impact of adhesives in wood panels. Recognises surface cleaners and explains their negative impact on the wood surface, the worker and the environment.	
Furniture construction	It takes account of ecological requirements and develops a sense of economic use of materials.	
Technological processes in wood processing	Develops attitudes towards the environment. Understands the advantages and disadvantages of different coatings from an ecological point of view. Applies ecological standards. Develops ecological awareness when working with hazardous waste.	
Woodworking machinery	Develops eco-consciousness of energy consumption in woodworking machinery	
Production technique	It recognises the importance of ecology and the efficient use of energy in the working	

	environment. It is aware of the economics of machine lines and robots. Is familiar with safety and ecological regulations. Develops ecological awareness.	
Design	It takes account of ecological requirements and develops a sense of economic use of materials. Observes the principles and regulations of occupational safety, environmental protection, fire safety and the rational use of energy, materials and time.	
Interior furnishing	It takes account of ecological requirements and develops a sense of economic use of materials.	
Sawmilling and drying	Can explain the basic processes involved in the extraction of forest products, with an emphasis on ecology. Knows how to use residues in an ecological way.	

Table 2: EQF 4 - Wood Technician: Comparison of the Industry 4.0 skills and knowledge already included in the modules with those proposed in Pathways to HE

Module	Industry 4.0 skills and knowledge already included in the modules	Industry 4.0 skills and knowledge suggested in »Pathways to HE«
Technical communication and computer use	Students understand the basic principles of ICT and how to use it. The student is familiar with the software, hardware and technical equipment used to carry out various work tasks. The student is familiar with basic operating systems and their functions. Uses computer programs to draw drawings and plans.	• Cross reality (VR, AR, MR) • Cloud computing • Online security • Internet of things (IoT) • Simulations • Autonomous (smart) robots • Big data • Additive productions -3D, 4D printing • Artificial intelligence
Company and work preparation	Use of information and communication technology.	
Design	Use information communication technology (3D drawing, activity planner, presentation software, etc.).	
Economics of production processes - optional course	Understands the development trends in IT and automation. Understands the different sources of information, how it is gathered and how it is used and influences business decisions. Uses modern information communication technology.	

Table 3: EQF 4 - Wood Technician: Comparison of the AAL skills and knowledge already included in the modules with those proposed in Pathways to HE

MODULE	AAL skills and knowledge already included in the modules	AAL skills and knowledge suggested in »Pathways to HE«
Furniture construction	Understands the influence of ergonomics on the design of seating furniture.	• Smart buildings • Smart furniture • Ergonomic interior design • Sensors • Fire and other safety
Interior furnishing - optional course	Knows the anthropometric data and ergonomic dimensions of furniture.	
Processing technology with occupational safety	They learn about fire safety and environmental protection.	

Table: 4: EQF 5 – Wood technology engineer: Comparison of the Circular economy skills and knowledge already included in the modules with those proposed in Pathways to HE

Module	Circular Economy skills and knowledge already included in the modules	Circular Economy skills and knowledge suggested in »Pathways to HE«
Surface treatments and wood protection	Describe wood preservatives and make an environmental judgement on the suitability and necessity of their use. Know the development guidelines for surface treatment and wood protection and the ecological constraints. Know the main sources of pollution, types of emissions and waste. Compare specific wastes and their management. Analyse the use of waste water treatment processes in surface treatment and wood preservation operations. Plans for the reduction of emissions and controls the storage of special wastes.	• Natural resources management • Renewable energy sources • Efficient and sustainable productions • Environmental effects • Circular business models • Industry symbioses • System thinking implementation • Biorefinery • Green chemicals • Bio economy • Functional materials (sustainable composites, advanced materials) • LCA analyses • Collection and recycling • Transperancy in supply chains • Hazardous chemicals
Energy in wood and furniture sector	It takes account of developments in energy and environmentally friendly technology. It plans for the use of clean energies and their rational use. Incorporates new technological solutions and modern energy-saving and environmentally friendly devices. Behaves rationally in energy consumption. Analyses and compares different methods of energy production in terms of economy, efficiency and environmental impact. Predict and analyse the amount of wood residues to be used for energy purposes. Plan the use and determine the type and size of a solar system.	
Sawmilling, veneer and panel technology	It takes care of the environment and environmentally friendly technological processes. It shall anticipate processes based on new ecological development guidelines.	

Furniture design and construction	It protects health, the environment and the choice of environmentally friendly materials and processes.	• Green public procurement • Nano technology
Artistic woodworking and wood-based materials	Analyses and evaluates the place and importance of different expressive techniques in wood in the contemporary economy and environment.	

Table 5: EQF 5 – Wood technology engineer: Comparison of the Industry 4.0 skills and knowledge already included in the modules with those proposed in pathways to HE

Module	Industry 4.0 skills and knowledge already included in the modules	Circular Economy skills and knowledge suggested in »Pathways to HE«
Computer and information science	Use a variety of software at basic and intermediate levels of complexity. Use of ICT equipment that allows communication and data exchange over the Internet. Use of software, hardware and working methods that facilitate the protection of data and information in computer systems and, consequently, in the enterprise. Participation in the implementation of ICT innovations, security policies and work in the ICT field.	• Cloud computing • Online security • Internet of things (IoT) • Simulations • Autonomous (smart) robots • Big data • Additive productions -3D, 4D printing • Artificial intelligence
Wood machining technology	Provide for the possibility of using devices to automate the production process. Analyse the level of automation and robotics. Plan the use of automation and robotics. Identifies automation applications and systems. Selects the appropriate technological equipment for automation, according to the technological process.	
Production quality and reliability	It identifies basic statistical methods in practice. Compares the basic concepts of statistics, data and variation. Formulates graphical expressions.	
CNC technology in woodworking	Describes the principle of communication between a computer and a machine. Practises manual programming, writes a computer program to be tested on a simulator. Uses modern computer tools for programming CNC machines to produce practical computer programs.	
Design and construction in the woodworking industry	The student uses modern computer aided drafting software in the design and construction process. of the task and presents it in a modern way using computer aided presentation techniques.	

Table 6: EQF 5 - Wood technology engineer: Comparison of the AAL skills and knowledge already included in the modules with those proposed in Pathways to HE

Module	AAL skills and knowledge already included in the modules	AAL skills and knowledge suggested in »Pathways to HE«
Study work in the woodworking industry	Uses anthropometric principles and considers the physiological characteristics of the human body when designing workplaces. Learn the basics of ergonomic workplace design.	• Smart buildings • Smart furniture • Ergonomic interior design • Sensors • Fire and other safety
Occupational safety, fire safety and environmental protection	Knows the possible causes of fire. Know what to do in the event of a fire. Knows mobile and built-in fire extinguishers and extinguishing media. Know the fire resistance of building elements and the concept of fire protection in buildings.	
Design and construction in the woodworking industry	Applies and observes the basics of functional layout, dimensioning, standards and housing types. Knows the importance of functionality and ergonomics in design and construction.	
Timber construction	Develops creative and original design solutions for timber construction. In collaboration with the work team (designer, co-operators, client), coordinates, argues and selects appropriate design and construction solutions for products.	
Furniture design and construction	Knows the anthropological data and ergonomic requirements in the design process of different types of furniture. Develops creative and original design solutions for furniture. Adapts to new needs and trends in the manufacture and installation of building and living furniture. Follows new discoveries in ergonomics and integrates them into the design and construction of living furniture.	

4. A PROPOSAL TO COMPLEMENT EXISTING QUALIFICATIONS WITH CIRCULAR ECONOMY, INDUSTRY 4.0 AND AAL SKILLS AND KNOWLEDGE AT EQF 4 AND EQF 5 LEVEL IN THE WOOD AND FURNITURE SECTOR

Based on the review presented in the tables above, we have concluded that some Circular economy, Industry 4.0 and AAL skills and knowledge are missing and should be updated in the existing qualifications. While our list is not exhaustive, it highlights the urgent need to integrate sustainable and digital skills and knowledge into VET educational and training programmes. These identified gaps are crucial for adapting our qualifications to the evolving needs of the modern workforce and expectations. By integrating these skills and knowledge, we aim to improve the relevance and applicability of our VET programmes, equipping learners with the essential skills they need to thrive in a rapidly changing global environment, particularly in the specialised wood and furniture sector:

EQF 4 -WOOD TECNITIAN: CIRCULAR ECONOMY

- Cascading use
- Efficient and sustainable productions
- Circular business models
- Industry symbioses
- System thinking implementation
- Bio economy
- Functional materials (sustainable composites, advanced materials)
- Transparency in supply chains
- Green public procurement

EQF 4 -WOOD TECHNITIAN: INDUSTRY 4.0

- Online security
- Internet of things (IoT)
- Autonomous (smart) robots
- Big data
- Artificial intelligence

EQF 4 -WOOD TECHNITIAN: AAL

- Sensors

EQF 5 -WOOD TECHNOLOGY ENGINEER: CIRCULAR ECONOMY

- Cascading use
- Circular business models
- Industry symbioses
- Bioeconomy
- Green public procurement

EQF 5 -WOOD TECHNOLOGY ENGINEER: INDUSTRY 4.0

- Internet of things (IoT)
- Autonomous (smart) robots
- Artificial intelligence

EQF 5 -WOOD TECHNOLOGY ENGINEER: AAL

- Smart furniture

CASE STUDY: THE NETHERLANDS

1. BODIES INVOLVED IN THE PROCESS OF UPDATING QUALIFICATIONS AND KEY DOCUMENTS FOR THE DESIGN OF QUALIFICATIONS

In the Netherlands, the foundation for cooperation on Vocational Education and Training (VET) and the labour market (SBB) is responsible for developing and maintaining the qualification structure for vocational education. SBB aims to ensure a strong connection between education and the job market.

In addition, they are responsible for establishing and maintaining VET qualification files and electives.

1. Qualification files

- Qualification files describe the requirements that students must meet to obtain a specific qualification in VET. They consist of various components, such as the description of the profession, core tasks and work processes, required knowledge, skills and professional competencies.
- SBB develops qualification files in consultation with representatives from the business sector, educational institutions, and other relevant stakeholders. This is done through qualification file committees.
- These committees study developments within specific professional groups, the needs of the business sector and any changes in laws and regulations. Based on this, the content and requirements of the qualification files are determined or revised.

2. Electives

Electives are

- parts of the VET programme that offer students the opportunity to specialize or broaden their education. They are intended to better meet the needs of the labour market or the personal interests of the student.
- developed by SBB in consultation with the same stakeholders as in the case of qualification files, including representatives from the business sector, education, and industry organizations.
- based on current developments in the field, needs from the work field, and input from the education field. They can, for example, focus on new technologies or specific skills.
- additions to students' regular training programmes, provided that certain conditions are met, such as obtaining the associated qualification and successfully completing the core tasks.

Through this structural collaboration between education and business, SBB ensures that qualification files and electives are relevant, up-to-date and align well with labour market requirements. This contributes to the quality and relevance of secondary vocational education in the Netherlands.

2. QUALIFICATIONS IN THE WOOD AND FURNITURE SECTOR AT EQF 2, 3 and 4 LEVEL

HMC offers various furniture courses. The courses are offered in Dutch.
Explanation of Dutch abbreviations:
BOL = school-based education
BBL = work-based education

- Furniture-/ (ship) interior builder (EQF 2 BOL/BBL)
- All-round furniture-/ (ship) interior builder (EQF 3 BOL/BBL)
- Entrepreneurial furniture- / (ship) interior builder (EQF 4 BOL)
- Furniture industry work planner/(ship) interior builder (EQF 4 BOL/BBL)
- Furniture upholsterer (EQF 2 BOL)
- All-round furniture upholsterer (EQF 3 BOL)
- Piano technician/entrepreneur (EQF 3 BOL)

HMC offers various technology courses.

- Wood technology assembly worker (EQF 2 BOL/BBL)
- All-round wood technology assembly worker (EQF 3 BOL/BBL)
- Wood technology work planner (wood talent) (EQF 4 BOL/BBL)

HMC offers various electives. See next page.
For the purpose of this task, the qualification **Entrepreneurial furniture-/ (ship) interior builder (EQF 4 BOL)** has been selected which should be updated with skills and knowledge on circular economy, industry 4.0 and AAL.

EQF 4: Entrepreneurial furniture-/ (ship) interior builder (EQF 4 BOL)
Basic component
Core task:
- B1-K1: Processing solid wood/panel material with woodworking machinery

Profile part
Core tasks:
- P6-K1: Assembling and finishing furniture and (ship) interior products
- P6-K2: Installing furniture and (ship) interiors
- P6-K3: Managing a furniture, (ship) interior company/department

Relevant electives in which Allview themes are/ should be included:
- Automized furniture making
- Digital techniques (3D-printing, laser cutting)
- Online programming CNC
- Experiment with materials and techniques
- Respond to innovations
- Home automation (AAL) and light in furniture

3. CIRCULAR ECONOMY, INDUSTRY 4.0 AND AMBIENT ASSISTED LIVING (AAL) SKILLS AND KNOWLEDGE THAT IS ALREADY INCLUDED IN THE EXISTING HMC-MODULES COMPARED TO THE PROPOSALS IN 'PATHWAYS TO HE'

Procedure
First, the skills and knowledge related to circular economy, industry 4.0 and AAL that are already included in the HMC modules were identified. Then they were compared with those proposed in the Pathways to HE report. The results of the comparison are presented in the tables below. Skills and knowledge already included in the modules are highlighted in green and underlined.

EQF 4 – Entrepreneurial furniture- / (ship) interior builder
Table 1: EQF 4 - Entrepreneurial furniture- / (ship) interior builder: **Circular economy skills and knowledge already included in the HMC modules compared with those proposed in pathways to HE.**

HMC Modules Basic school subjects & components	Circular economy skills and knowledge already included in the modules	Circular economy skills and knowledge suggested in »Pathways to HE«
Theory furniture making	At the end of their studies, students are able to assess the sustainability level of their own furniture. Starting from the first	• Eco Design • Cascading use

	year, they are offered a curriculum with knowledge and skills for this purpose. This curriculum covers sustainable design (such as dismantlability and longevity), sustainable materials, and sustainable entrepreneurship. Topics include sustainable forest management, sustainable certifications, minimizing leftover materials, greenwashing, and circular business models. As a model for sustainability HMC has developed the HMC value hill, which enables students to learn how to make sustainable choices.	• Natural resources management • Renewable energy sources • Efficient and sustainable productions • Environmental effects • Circular business models • Industry symbioses • System thinking implementation • Biorefinery • Green chemicals • Bio economy • Functional materials (sustainable composites, advanced materials) • LCA analyses • Collection and recycling • Transparency in supply chains • Hazardous chemicals • Green public procurement • Nano technology
Practical furniture making	Working with sustainable materials (biobased, local wood, residues, reused and recycled materials) and manufacturing techniques (dismantlable connections). Utilizing natural adhesives and finishing agents. Assessing workpieces using the 'sustainability metre' developed by the organization, where sustainable choices and techniques are rated on a scale from 1 to 5.	
Workshops and company visits and trade fairs	Every year workshops for our students centred around the theme of sustainability and innovation are organized. Examples include the repair workshop and the concept that "waste is a design mistake." Throughout the year, various company and trade fair visits are organized, including visits to innovative and sustainable companies and trade fairs.	
(International) Internship at a company	Students are given assignments to assess the sustainability practices within the company where they are completing their internships. They are asked to consider how the company can become even more sustainable.	
Work planning	Making material choices and optimizing their usage efficiently. Minimizing waste through thoughtful design.	
Managing a furniture, (ship) interior company/department	Circular business models and marketing. Socially responsible entrepreneurship, Social Development Goals. Saving space and storage, conserving energy.	
Citizenship	Students receive instruction on the Sustainable Development Goals (SDGs). This is to enhance awareness of sustainability and promote global awareness. These lessons also emphasize	

	making sustainable choices in their own lives.	
Relevant electives in which the Allview themes are included		
Experiment with materials and techniques	At the moment, the lessons focus on researching materials and/or techniques for creating the final project. The aim is to incorporate sustainability into this aspect of education.	

Table 2: EQF 4 - Entrepreneurial furniture- / (ship) interior builder: Industry 4.0 skills and knowledge already included in the modules compared with those proposed in Pathways to HE

Basic school subjects & components	Industry 4.0 skills and knowledge already included in the modules	Industry 4.0 skills and knowledge suggested in »Pathways to HE«
Theory furniture making	Students learn how to prototype their furniture using 3D printers and its software. Before they have made a model, they learn how to view it with the help of VR glasses.	• Cross reality (VR, AR, MR) • Cloud computing • Online security • Internet of things (IoT) • Simulations • Autonomous (smart) robots • Big data • Additive productions -3D, 4D printing • Artificial intelligence
Practical furniture making	In these practical lessons, students create for example connector parts for their furniture using 3D printing. There is a robot at school that can scour. Students learn to work with this. In addition, they are given an assignment to learn how to work with the Shaper origin (a hand-held CNC machine).	
Workshops and company visit and trade fairs	At the end of each 9 to 10 week period (4 periods in one school year), there is a week in which students can choose from various workshops, e.g. 3D scanning, VR, working with a Shaper origin (a hand-held CNC machine). Students get inspiration during trade fair visits about the 'twin transition', using new techniques to become more sustainable. An example is the reuse of plastic to use in furniture with the help of new techniques.	
(International) Internship at a company	Students can do their internships at companies that apply various new techniques. Think of working with robots and automating the production line.	
Work planning	Students learn parametric design. They also prepare for a 3D prototype.	
Managing a furniture, (ship) interior company/department	So far, this module has been more about managing staff in a furniture company. The new techniques are not broadly discussed.	

Citizenship	During the citizenship lessons, students learn about how to use social media and the internet safely.	
Electives Relevant to Allview		
Experiment with materials and techniques	Students are free to try out all the new techniques out there. The school facilitates this at the HMC lab. Innovative manufacturing techniques are available here. Think of laser cutters, 3D printers, 3D scanners, robot arm, etc.	
Automized furniture making	Students learn about techniques with which you can produce parametrically automated as a company. They get to work virtually setting up a production line. After that, they have to write a report to evaluate whether it could be done more efficiently. New techniques are in the spotlight in this elective.	
Digital techniques (3D printing, laser cutting)	Students are given the assignment to create a product using digital production techniques: 3D printing and laser cutting.	
Online programming CNC	Students learn to control a CNC machine via an online software package. They need to program and simulate complex CNC machining.	
Respond to innovations	Students keep an eye on all innovations for the industry and conduct research on them.	
Home automation (AAL)and light in furniture	This elective is under construction. The application of sensors to perform actions is central. Home automation techniques are used.	

Table 3: EQF 4 Entrepreneurial furniture- / (ship) interior builder**: AAL skills and knowledge already included in the HMC modules compared with those proposed in Pathways to HE.**

Basic school subjects & components	AAL skills and knowledge already included in the modules	AAL skills and knowledge suggested in »Pathways to HE«
Theory furniture making	Brief theory about anthropometric data and ergonomic dimensions of furniture.	• Smart buildings • Smart furniture • Ergonomic interior design • Sensors
Practical furniture making	Students create a piece of furniture that is ergonomically well-constructed.	

Work planning	Students design a piece of furniture that is ergonomically well-constructed.	• Fire and other safety
Workshops and company visits and trade fairs	As part of the Allview student exchange program, a workshop on AAL (Ambient Assisted Living) was conducted for teachers, company employees, and students.	
Electives Relevant to Allview		
Home automation (AAL)and light in furniture	This optional component is under development. There are plans to include AAL (Ambient Assisted Living) in it.	

4. A PROPOSAL TO COMPLEMENT EXISTING QUALIFICATIONS WITH CIRCULAR ECONOMY, INDUSTRY 4.0 AND AAL SKILLS AND KNOWLEDGE AT EQF 4 AND EQF 5 LEVEL IN THE WOOD AND FURNITURE SECTOR

Based on the review presented in the tables above, the conclusion is that in the current curriculum ample attention is paid to circular economy and industry 4.0 in the basic school subjects as well as electives and other components. To stay future proof the aim to is set up the school in such a way that innovations are given a permanent place.

There is a constant focus to search for information about sustainable and innovative materials to be integrated into the curriculum. The life cycle analysis (LCA) an important tool to measure in an objective manner the level of sustainability of materials. A disadvantage is that many materials do not yet have an LCA. Therefore tools that can easily classify materials according to their degree of sustainability, such as intermatter, are investigated for.

New techniques are discussed in various electives that students can choose based on their own interests. A more prominent place for it in the basic school subjects and components is desired. For this, it is necessary to train teachers and instructors and make them enthusiastic. Sometimes there seems to be some 'fear' of new techniques because they think the old craft will disappear as a result.

Because developments in the field of new techniques are moving so fast, HMC finds it important to teach students and encourage teachers and instructors to remain inquisitive. AI is going to play a big role in the industry in the future. The advantages and disadvantages in relation to each education at HMC need to be studied.

Concerning AAL, students need to be able to design furniture with sensors incorporated into it, so that people can live independently at home for longer. Because this subject is not described in the compulsory learning objectives of the study programmes, it will be included in the elective on home automation. The processing of light in furniture using sensor technology is a skill that is important for students to learn.

Safety is an important topic when it comes to furniture design. Students should have knowledge about the flammability and toxicity of materials they work with. The curriculum will be looked at profoundly to see if enough attention has already been paid to this subject.

EQF 4 - Enterprising furniture maker / (ship-) interior builder: CIRCULAR ECONOMY

- Industry symbioses
- Biorefinery
- LCA analyses

- Green public procurement
- Nano technology

EQF 4 - Enterprising furniture maker/(ship) interior builder: INDUSTRY 4.0

- Cloud computing
- Internet of things (IoT)
- Simulations
- Big data
- Artificial intelligence

EQF 4 - Enterprising furniture maker/(ship) interior builder: AAL

- Smart buildings
- Smart furniture
- Sensors
- Fire and other safety

CASE STUDY: SPAIN - REGION OF MURCIA

1. BODIES INVOLVED IN THE PROCESS OF UPDATING QUALIFICATIONS AND KEY DOCUMENTS FOR THE DESIGN OF QUALIFICATIONS

The Certificates of Professionalism are the official accreditation instrument for the professional qualifications of the National Catalog of Professional Qualifications in the field of Labor Administration.

The Certificate of Professionalism, regulated by Royal Decree, will be official and valid throughout the national territory and will be issued by the State Public Employment Service and the competent bodies of the Autonomous Communities.

In the case of the wood, furniture and cork family, 18 Professional Certificates can be found at the state level, but only 10 are taught in the different training centers located in the Autonomous Community of the Region of Murcia. The Professional Certificates correspond to levels 1, 2 and 3, which translated into the European Qualifications Framework correspond to EQF 2, 3, 4 and 5

2. QUALIFICATIONS IN THE WOOD AND FURNITURE SECTOR AT EQF 4 AND EQF 5 LEVEL

Professional certificates are based on the national level. There are 7 qualifications that correspond to level EQF4 and 3 that correspond to level EQF 5 in the furniture and wood sector.

EQF 4

- Wood sawing
- Assembly of furniture and carpentry elements
- Carpentry and furniture finishing
- Machining of wood and derivatives
- Furniture installation
- Installation of carpentry elements

EQF 5

- Installation and furnishing projects
- Manufacturing planning and management in wood and cork industries
- Carpentry and furniture projects

For the purpose of this task, we have selected the qualifications Assembly of furniture and carpentry elements at level EQF 4 and Installation and furnishing project at level EQF5 that must be updated with the skills and knowledge in Circular Economy, Industry 4.0 and AAL

EQF 4: Assembly of furniture and carpentry elements

Occupational skills

The candidate is able to:

- Assemble, adjust and assemble furniture and carpentry elements
- eXception of components and accessories, storage and classification thereof
- Transfer of parts using mechanical or manual means
- Use of automatic and manual machines for the assembly of furniture and carpentry elements
- Performing product quality controls
- Packaging of products by manual or automatic means for subsequent storage or dispatch
- Use of computer programs for stock and warehouse management
- Knowledge of the characteristics of the materials used in the assembly processes
- Knowledge and application of environmental and occupational health regulations

EQF 5: Installation and furnishing project

Occupational skills

The candidate is able to:

- Define and develop furniture and installation projects of carpentry and furniture
- Supervision of installation and installation operations
- Carry out data collection and specifications according to client requests
- Develop the graphic documentation of the Project through manual or computer means
- Preparation of budgets through manual or computer means
- Management of graphical representation computer programs, spreadsheets, measuring and plotting tools and supplies.
- Coordinate and control the execution of tasks
- Plan the assembly and installation considering the different human factors involved
- Knowledge of the materials to be used and the specific building regulations
- Knowledge and application of environmental and occupational health regulations

3. CIRCULAR ECONOMY, INDUSTRY 4.0 AND AMBIENT AND ASSISTED LIVING (AAL) SKILLS AND KNOWLEDGE THAT ARE ALREADY INCLUDED IN THE EXSISTED MODULES COMPARED TO THE PROPOSALS IN »PATHWAYS TO HE«

First, we have reviewed the modules included within the professionalism certificates Assembly of furniture and carpentry elements and Installation and furnishing project and we

have identified the skills and knowledge related to the Circular Economy, Industry 4.0 and AAL that are already included in the modules. These skills and knowledge have been compared with those proposed in the Pathway to HE report. The results of the comparison are presented in the tables below. The skills and knowledge already included in the modules are outlined in green.

EQF 4 - Assembly of furniture and carpentry elements

Table 1: EQF4 - Assembly of furniture and carpentry elements: Comparison of the Circular Economy skills and Knowledge already included in the modules with those proposed in Pathways to HE.

Module	Circular Economy skills and knowledge already included in the modules	Circular Economy skills and knowledge suggested in »Pathways to HE«
Reception control, components and accessories	The student identifies the applicable environmental regulations in the reception of components and accessories based on the products used, as well as the waste generated.	• Eco Design • Cascading use • Natural resources management • Renewable energy sources • Efficient and sustainable productions • Environmental effects • Circular business models • Industry symbioses • System thinking implementation • Biorefinery • Green chemicals • Bio economy • Functional materials (sustainable composites, advanced materials) • LCA analyses • Collection and recycling • Transparency in supply chains • Hazardous chemicals • Green public procurement • Nano technology
Assembly of furniture and carpentry elements	The student is able to understand and describe the furniture and carpentry assembly process, knowing the different types of existing wood and identifying the environmental regulations applicable to its use. The student is aware of the environmental regulations regarding the products used as adhesives, glues and silicones, as well as the waste that is generated.	
Adjustment and packaging of furniture and carpentry elements	Apply environmental regulations regarding the materials used in the packaging of furniture and carpentry (cardboard, plastic, expanded polyurethane, among others), detailing their characteristics and identifying the waste generated, its use, elimination, transportation, separation and storage.	

Table 2: EQF 4 - Assembly of furniture and carpentry elements. Comparison of the Industry 4.0 skills and Knowledge already included in the modules with those proposed in Pathways to HE.

Module	Industry 4.0 skills and knowledge already included in the modules	Industry 4.0 skills and knowledge suggested in »Pathways to HE«
Reception control, components and accessories	The student acquires knowledge about smart warehouses and stock management through the use of computer programs. Also the student acquires Knowledge about how to use peripherals: barcode printer, barcode readers, radio frequency; and about automatic transport within the warehouse	• Cross reality (VR, AR, MR) • Cloud computing • Online security • Internet of things (IoT) • Simulations • Autonomous (smart) robots • Big data • Additive productions - 3D, 4D printing • Artificial intelligence
Assembly of furniture and carpentry elements	Use of automatic machines after adjustment of the required parameters	
Adjustment and packaging of furniture and carpentry elements	Identification of the equipment used, describing its setup and operation, as well as the operations for its maintenance and conservation	

Table 3: EQF 4 - Assembly of furniture and carpentry elements. Comparison of the AAL skills and Knowledge already included in the modules with those proposed in Pathways to HE.

Module	AAL skills and knowledge already included in the modules	AAL skills and knowledge suggested in »Pathways to HE«
Reception control, components and accessories	The student learns and applies occupational health and safety regulations. They know the risk of materials and accessories: the level of toxicity, degree of combustibility and flammability, and the physical risks generated by their reception and handling, as well as knowledge of prevention and extinction systems.	• Smart buildings • Smart furniture • Ergonomic interior design • Sensors • Fire and other safety
Assembling furniture and joinery elements	The student incorporates the product regulations and standard dimensions into the furniture assembly.	

Table 4: EQF 5 - Installation and furnishing project: Comparison of the Circular Economy skills and Knowledge already included in the modules with those proposed in Pathways to HE.

Module	Circular Economy skills and knowledge already included in the modules	Circular Economy skills and knowledge suggested in »Pathways to HE«

Development of installation and furnishing projects	Selection of materials that comply with environmental regulations	• Eco Design • Cascading use • Natural resources management • Renewable energy sources • Efficient and sustainable productions • Environmental effects • Circular business models • Industry symbioses • System thinking implementation • Biorefinery • Green chemicals • Bio economy • Functional materials (sustainable composites, advanced materials) • LCA analyses • Collection and recycling • Transparency in supply chains • Hazardous chemicals • Green public procurement • Nano technology
Supply of elements for the installation of carpentry and furniture	The student is knowledgeable about environmental regulations applied to the control of supplies and manufacturing of products for installation and furnishing projects.	
Supervision of the assembly of carpentry and furniture installations	The student acquires skills on the treatment of waste generated, its use and disposal, as well as the methods and means used.	

Table 5: EQF 5 - Installation and furnishing project: Comparison of the Industry 4.0 skills and Knowledge already included in the modules with those proposed in Pathways to HE.

Module	Industry 4.0 skills and knowledge already included in the modules	Industry 4.0 skills and knowledge suggested in »Pathways to HE«
Development of installation and furnishing projects	Students acquire knowledge about computer design programs: development of plans with 2D computer-assisted drawing programs, development of installation and furnishing solutions using 3-dimensional design software, creation of environments and rendering, and 2D and 3D printing.	• Cross reality (VR, AR, MR) • Cloud computing • Online security • Internet of things (IoT) • Simulations • Autonomous (smart) robots

		• Big data • Additive productions -3D, 4D printing • Artificial intelligence

Table 6: EQF 5 - Installation and furnishing project: Comparison of the AAL skills and Knowledge already included in the modules with those proposed in Pathways to HE.

Module	AAL skills and knowledge already includes in the modules	AAL skills and knowledge suggested in »Pathways to HE«
Development of installation and furnishing projects	Regarding to ambient assited living, the students learn about: selection of products to install considering that the materials to be used are within the building regulations: fire resistance, emission of harmful gases, etc; the regulations of ergonomic aspects, and how to modify materials taking into account ergonomic and functional requirements of the client and the space	• Smart buildings • Smart furniture • Ergonomic interior design • Sensors • Fire and other safety
Supervision of the assembly of carpentry and furniture installations	Check the characteristics of the installation are in line with the emergency plans and are adapted to the clients and users.	

4. A PROPOSAL TO COMPLEMENT EXISTING QUALIFICATIONS WITH CIRCULAR ECONOMY, INDUSTRY 4.0 AND AAL SKILLS AND KNOWLEDGE AT EQF 4 AND EQF 5 LEVEL IN THE WOOD AND FURNITURE SECTOR

Having examined the Professional Certificates presented above, we believe that it is necessary to update the training received by students in terms of concepts related to the circular economy and the use of new technologies, to be able to cope with the rapid changes that arise in the wood and furniture sector. Updated training allows for improved skills and greater job insertion of workers within the sector. At the same time, companies can face the challenges presented to them to be more competitive in a demanding global market.

EQF 4 - Assembly of furniture and carpentry elements: CIRCULAR ECONOMY -Cascading use -Circular business models -Industry symbioses -Bio economy -Functional materials (sustainable composites, advanced materials) -Green public procurement	EQF 4 - Assembly of furniture and carpentry elements: INDUSTRY 4.0 -Online security -Internet of things (IoT) -Big Data -Artificial Intelligence	EQF 4 - Assembly of furniture and carpentry elements: AAL -Smart furniture -Ergonomic interior design -Sensors
EQF 5 - Installation and furnishing project: CIRCULAR ECONOMY -Renewable energy source -Eco Design -Cascading use -Natural resources management -Renewable energy sources	EQF 5 - Installation and furnishing project: INDUSTRY 4.0 -Cloud computing -Online security -Internet of Things -Autonomous robots -Big Data -Artificial Intelligence	EQF 5 - Installation and furnishing project: AAL -Smart Furniture -Smart building -Sensors

CASE STUDY: ITALY

1. BODIES INVOLVED IN THE PROCESS OF UPDATING QUALIFICATIONS AND KEY DOCUMENTS FOR THE DESIGN OF QUALIFICATIONS

In Italy, Vocational education and training (VET) programs are designed in a multilevel dialogue among the Ministry of Education, the Ministry of Labour and Social Policies, the Regions where the specific programs are delivered, the Autonomous Provincies, the different stakeholders involved, such as chambers of commerce, companies, employer and trade unions, VET centers, institutional bodies. Such dialogue in grounded on the supply and demand analysis of skills and competences that each industrial sector outlines. While the Ministries draw the guidelines to structure the vocational education and training systems, the Regions and Autonomous Provinces are responsible to implement these systems. The dialogue between the state and regional levels is guaranteed by the Conferenza Stato-Regioni (state-region conference). Since the programs are regionally defined, to provide an example it is possible to briefly analyze the case of Lombardy Region. In this region, competences and professional profiles are classified by the Regional Framework of Professional Standards (Quadro Regionale degli Standard Professionali – QRSP), which is built upon the National Repertoire and the National System of Skills Certification. The QRSP is structured in twenty-four professional economic sectors from the National Repertoire and presents six sections: (1) professional profiles and independent skills; (2) basic skills; (3) cross-

sectoral/soft skills; (4) bio-natural skills; (5) regulated/enabling skills; (6) regulated training paths. The Regional Framework of Professional Standards is correlated to the Atlas of Work and Qualifications, a document that link different economic-professional sectors to the levels of the National Framework of Qualifications.

2. QUALIFICATIONS IN THE WOOD AND FURNITURE SECTOR AT EQF 4 AND EQF 5 LEVEL

At a national level, the VET qualifications corresponding to EQF 4 and EQF 5 are declined in three different paths:

- EQF 4 corresponds to the IV year of the vocational education and training system – or IeFP (which stands for Istruzione e Formazione Professionale);
- EQF 4 corresponds also to the one-year program that bridges the EQF 4 and EQF 5 in VET, having the acronym of IFTS – Istruzione e Formazione Tecnico Professionale;
- EQF 5 corresponds to two (and in some cases, three) years of Higher VET, structured in Italy with the so called ITS Academy.

Concerning the vocational education and training system and Higher VET in the wood and furniture sector, EQF 4 and EQF 5 are declined in these qualifications:

EQF 4

- IV year of IeFP: Wood Technician
- One-year IFTS: Technician for design and prototyping 4.0

EQF 5

- ITS Academy: Higher Technician for the sustainable design and innovation in the wood and furniture sector

In this task it will be analyzed the qualification of "Wood technician" at EQF level 4 and "Higher Technician for the sustainable design and innovation in the wood and furniture sector" at EQF level 5 that should be updated with skills and knowledge on Circular economy, Industry 4.0 and AAL.

EQF 4: WOOD TECHNICIAN

The "wood technician" intervenes autonomously, within the established framework of action and of the assigned specifications, contributing in relation to the different directions to the supervision of the processes relating to the second transformation of wood and panel production, to the manufacture of wooden parts for carpentry and construction, to the production, restoration and repair of furniture and wooden artefacts, the inlaying of wooden artefacts and the decoration and painting of wooden artefacts. He has functional skills in relation to the different directions of preparation, monitoring, care and maintenance of tools, tools, equipment and machinery, to documentation and reporting of activities, the production and finishing of products different typology.

The candidate is able to:

- Operate safely and in compliance with hygiene standards and environmental protection, identifying and preventing risky situations for themselves, for others and for the environment;
- Prepare, monitor and take care of maintenance of tools, equipment and instruments, as well as machineries;
- Take care of the necessary documentation of the activities and materials, in the different stages of progress;

- Collaborate on the ideation and on the graphic processing of wooden artifacts with specific technical characteristics;
- use modern information and communication technology in their work;

EQF 5: HIGHER TECHNICIAN FOR THE SUSTAINABLE DESIGN AND INNOVATION IN THE WOOD AND FURNITURE SECTOR

The "Higher Technician for the sustainable design and innovation in the wood and furniture sector" fits into the production area, monitoring the prototyping and production process, following the entire supply chain of the product, from the initial sketch to the production and market placing. The technician is able to use simulation tools and develop virtual models of the prototype, selecting the appropriate production approach between additive and subtractive manufacturing. Moreover, the technician is able to project and produce smart product, using environmentally sustainable materials, with a minor impact throughout their life cycle.

The candidate is able to:

- realize projects of new products with methodologies and technics of design for manufacturing;
- organize and manage production processes in the woodworking industry effectively,
- successfully introduce technological and organizational innovations into technological processes;
- choose materials that are environmentally sustainable and with adequate properties;
- use modern information and communication technology in their work;
- Operate safely and in compliance with hygiene standards and environmental protection, identifying and preventing risky situations for themselves, for others and for the environment;
- Contribute to the evaluation of the economic feasibility of the new product, based on the feedback for the industrial scale production;
- Use AI-based tools to design and choose materials.
- CAD/CAM skills

3. CIRCULAR ECONOMY, INDUSTRY 4.0 AND AMBIENT AND ASSISTED LIVING (AAL) SKILLS AND KNOWLEDGE THAT ARE ALREADY INCLUDED IN THE EXSISTED MODULES COMPARED TO THE PROPOSALS IN »PATHWAYS TO HE«

Procedure

Firstly, we reviewed the modules included in "Wood Technician" and "Higher Technician for the sustainable design and innovation in the wood and furniture sector" and then identified the skills and knowledge related to the Circular Economy, Industry 4.0 and AAL that are already included in the modules. These skills and knowledge were compared with those proposed in the Pathways to HE report. The results of the comparison are presented in the tables below. Skills and knowledge already included in the modules are highlighted in green and underlined.

EQF 4 - WOOD TECHNICIAN

Table 1: EQF 4 - Wood Technician: Comparison of the Circular Economy skills and knowledge already included in the modules with those proposed in Pathways to HE.

Module	Circular Economy skills and knowledge already included in the modules	Circular Economy skills and knowledge suggested in »Pathways to HE«
Wood and wood properties	Students learn to use different typologies of wood, understanding the kind of waste they produce after several processes	• Eco Design • Cascading use • Natural resources management • Renewable energy sources • Efficient and sustainable productions • Environmental effects • Circular business models • Industry symbioses • System thinking implementation • Biorefinery • Green chemicals • Bio economy • Functional materials (sustainable composites, advanced materials) • LCA analyses • Collection and recycling • Transparency in supply chains • Hazardous chemicals • Green public procurement • Nano technology
Furniture construction	It takes account of ecological requirements and develops a sense of economic use of materials.	
Woodwork and processing, machinery and production technique.	CAD/CAM programming and CNC application, with a specific focus on the specific tools used, in order to reduce the waste and use the most material available.	
Design	Ability to use 3D drawing and presentation software	
Quality Management	ISO 9001:2015 principles and main application in the furniture sector supply chain.	
Scientific processes	Students analyze the main scientific processes related to the wood and furniture industry, with specific attention to materials' properties and the ecological impact.	

Table 2: EQF 4 - Wood Technician: Comparison of the Industry 4.0 skills and knowledge already included in the modules with those proposed in Pathways to HE

Module	Industry 4.0 skills and knowledge already included in the modules	Industry 4.0 skills and knowledge suggested in »Pathways to HE«
Digital skills	Students understand the basic principles of ICT and how to use it. The student is familiar with the software, hardware and technical equipment used to carry out various work tasks. The student is familiar with basic operating systems and their	• Cross reality (VR, AR, MR) • Cloud computing • Online security

	functions. Uses computer programs to draw drawings and plans.	• Internet of things (IoT) • Simulations • Autonomous (smart) robots • Big data • Additive productions -3D, 4D printing • Artificial intelligence
Design	Ability to use 3D drawing and presentation software	
Woodwork and processing, machinery and production technique.	CAD/CAM programming and CNC applications, with a specific focus on the automation possibilities of the machines.	

Table 3: EQF 4 - Wood Technician: Comparison of the AAL skills and knowledge already included in the modules with those proposed in Pathways to HE

MODULE	AAL skills and knowledge already included in the modules	AAL skills and knowledge suggested in »Pathways to HE«
Design	Use information communication technology (3D drawing, activity planner, presentation software, etc.).	• Smart buildings • Smart furniture • Ergonomic interior design • Sensors • Fire and other safety
Furniture construction	It takes account of ecological requirements and develops a sense of economic use of materials.	

Table: 4: EQF 5 – Higher Technician for the sustainable design and innovation in the wood and furniture sector: Comparison of the Circular economy skills and knowledge already included in the modules with those proposed in Pathways to HE

Module	Circular Economy skills and knowledge already included in the modules	Circular Economy skills and knowledge suggested in »Pathways to HE«
Interior design principles	Awareness about the relation between furniture design and circular economy (design, material properties, production and distribution).	• Natural resources management • Renewable energy sources • Efficient and sustainable productions • Environmental effects • Circular business models • Industry symbioses • System thinking implementation • Biorefinery • Green chemicals • Bio economy
Metadesign	Application of the metadesign methodology CE principles	
CAD/CAM programming	Devolop new design ideas, based on specific customer request, through CAD/CAM softwares and 3D representations.	
Modelling and prototyping 4.0 technics	Use 4.0 predictive analytics solutions to better comprehend the wood and furniture industry demands.	
Material technologies	Ability to choose adequate materials in the design and production processes with a low ecological impact.	

		• Functional materials (sustainable composites, advanced materials) • LCA analyses • Collection and recycling • Transperancy in supply chains • Hazardous chemicals • Green public procurement • Nano technology

Table 5: EQF 5 – Higher Technician for the sustainable design and innovation in the wood and furniture sector: Comparison of the Industry 4.0 skills and knowledge already included in the modules with those proposed in pathways to HE

Module	Industry 4.0 skills and knowledge already included in the modules	Circular Economy skills and knowledge suggested in »Pathways to HE«
Lean Manufactiring in the wood and furniture sector	Abilities to apply principles and practices aimed at maximizing efficiency, minimizing waste and enhancing the whole production process.	• Cloud computing • Online security • Internet of things (IoT) • Simulations • Autonomous (smart) robots • Big data • Additive productions -3D, 4D printing • Artificial intelligence
CNC technology in woodworking	Describes the principle of communication between a computer and a machine. Practises manual programming, writes a computer program to be tested on a simulator. Uses modern computer tools for programming CNC machines to produce practical computer programs.	
Ecodesign	Students learn how to design new product, integrating in the design process ecological and environmental considerations and in relation with 4.0 processing solutions.	

Table 6: EQF 5 - Higher Technician for the sustainable design and innovation in the wood and furniture sector: Comparison of the AAL skills and knowledge already included in the modules with those proposed in Pathways to HE

Module	AAL skills and knowledge already included in the modules	AAL skills and knowledge suggested in »Pathways to HE«
Wooden construction technics	Applies and observes the basics of functional layout, dimensioning, standards and housing types. Knows the importance of functionality and ergonomics in design and construction	• Smart buildings • Smart furniture • Ergonomic interior design

Ecodesign	Students learn how to design new product, integrating in the design process ecological and environmental considerations and in relation with 4.0 processing solutions.	• Sensors • Fire and other safety

4. A PROPOSAL TO COMPLEMENT EXISTING QUALIFICATIONS WITH CIRCULAR ECONOMY, INDUSTRY 4.0 AND AAL SKILLS AND KNOWLEDGE AT EQF 4 AND EQF 5 LEVEL IN THE WOOD AND FURNITURE SECTOR

Based on the review presented in the tables above, we have concluded that some Circular economy, Industry 4.0 and AAL skills and knowledge are missing and should be updated in the existing qualifications. While our list is not exhaustive, it highlights the urgent need to integrate sustainable and digital skills and knowledge into VET educational and training programmes. These identified gaps are crucial for adapting our qualifications to the evolving needs of the modern workforce and expectations. By integrating these skills and knowledge, we aim to improve the relevance and applicability of our VET programmes, equipping learners with the essential skills they need to thrive in a rapidly changing global environment, particularly in the specialised wood and furniture sector:

EQF 4 -WOOD TECNITIAN: CIRCULAR ECONOMY

- Cascading use
- Efficient and sustainable productions
- Circular business models
- Bio economy
- Functional materials (sustainable composites, advanced materials)
- Transparency in supply chains

EQF 4 -WOOD TECHNITIAN: INDUSTRY 4.0

- Online security
- Artificial intelligence principles

EQF 4 -WOOD TECHNITIAN: AAL

- Sensors

EQF 5 - Higher Technician for the sustainable design and innovation in the wood and furniture sector:

CIRCULAR ECONOMY

- Cascading use
- Circular business models
- Industry symbioses
- Bioeconomy
- Green public procurement

AAL

- Smart furniture

CASE STUDY: POLAND

1. BODIES INVOLVED IN THE PROCESS OF UPDATING QUALIFICATIONS AND KEY DOCUMENTS FOR THE DESIGN OF QUALIFICATIONS

VET has three governance levels: national (ministries), regional (school superintendents, mainly in pedagogical supervision) and county (powiat – managing schools). The Ministry of Education and Science consolidates tasks relating to education, higher education, and science within one institution. It is also in charge of VET policies at all levels, supported by other ministries responsible for particular occupations. Social partners advise policy makers on necessary changes in VET.

The ministry is supported by the Vocational School Directors Council (Rada Dyrektorów Szkół Zawodowych) established as a consultative body in 2018. It consists of 42 school directors from vocational schools representing all regions of the country and different sectors. In each region, education authorities appointed coordinators – in total 31 coordinators – for vocational education and training, responsible for supporting cooperation between schools and employers, as well as promoting activities to develop vocational guidance and counselling in the education system. Most public education institutions in Poland are managed by local government units. Counties (powiaty) are responsible for upper secondary schools, including vocational schools, and schools for children with special needs; the regions (województwa) are responsible for schools of regional and trans-regional significance, such as groups of schools or vocational schools important for the regional economy.

Central government units (usually ministries) often manage vocational and fine arts schools. All types of schools can be established and managed by non-public institutions, such as religious and social associations. The share of non-public institutions is increasing as the level of education is higher.

The VET programmes available at the national level are developed on the basis of three regulations of the education ministry:

- the classification of occupations for vocational education;
- the core curricula for vocational education;
- the core curriculum for general education.

The classification includes the list of occupations for which VET programmes can be provided. Qualifications are distinguished within occupations; each occupation can be made up of either one or two qualifications.

The introduction of new occupations to the classification is regulated by the Education Law. The classification of occupations is determined by the education minister in cooperation with the relevant ministers responsible for a given sector of the economy, who can submit their requests to include particular occupations in the classification. To anticipate labour market needs, representatives of employers and employees are consulted during the development stage of the classification.

Regarding to updating it should be pointed that professional associations, organisations of employers, sector skills councils, social partners and other stakeholder organisations can submit their proposals to the relevant minister to establish a new occupation; in this way they shape the educational offer of the formal VET system. After the

proposal has been approved, the education minister includes the occupation in the classification and appoints a working group to design the core curriculum for vocational education for that occupation.

The working group contacts the institution which submitted the proposal for the new occupation to determine the learning outcomes; it then undertakes consultations with other experts in the field. At this stage, occupational standards, which are developed by the labour ministry, are considered.

The decision to provide education for a particular occupation listed in the classification of occupations for vocational education is made at local level by the school principal in agreement with local authorities (county level) and after asking the regional labour market councils (advisory bodies) for their opinion concerning compliance with labour market needs. Teaching programmes can be developed individually by schools. The school principal is responsible for incorporating the learning outcomes in the teaching programme and providing the organisational requirements as defined in the core curricula.

2. QUALIFICATIONS IN THE WOOD AND FURNITURE SECTOR AT EQF 4 AND EQF 5 LEVEL

Qualifications in the wood and furniture sector in Poland refer to the European Qualifications Framework (EQF) level 4 and level 5 with specific vocational training, internships, and higher educational qualifications. Each of them is described by means of the general characteristics of the scope and complexity of knowledge, skills and social competence required from persons with a given level of qualifications.

EQF 4

Vocational Training:

- At EQF Level 4, individuals might undergo vocational training programs specializing in:
  - woodworking, carpentry, or furniture making (3-year of 1st stage sectoral vocational school and then 2-year of 2nd stage sectoral vocational school;
  - wood technology technician (5-year technical secondary school).
- Qualifications at this level focus on developing practical skills in woodworking techniques, furniture assembly, material handling, basic design principles, and machinery operation.

EQF 5

3. Advanced Vocational Training / Technical Specialist Qualifications:
   - EQF Level 5 qualifications in the wood and furniture sector might include advanced vocational training or specialized technical qualifications.
   - For students who have completed their initial vocational training and gained practical experience might pursue further education to specialize in areas like furniture design, production management, or technical aspects of woodworking.
   - Advanced vocational programs at this level could focus on CNC (Computer Numerical Control) machining, specialized furniture construction, product design, quality control, or business administration related to the wood and furniture industry.

4. Higher Education Programs:

- Bachelor's degree programs in Poland in technical fields such as wood technology, furniture design with a focus on wood and furniture manufacturing is aligned with EQF Level 5.

For the purpose of the task, the following qualifications were selected: Technician of Wood Technology at EQF level 4 and qualification Wood Technology Engineer at EQF level 5 to be updated with skills and knowledge on Circular economy, Industry 4.0 and AAL.

EQF 4: TECHNICIAN OF WOOD TECHNOLOGY

Occupational competences

The candidate will be prepared to:

- make products based on wood and wood-based materials,
- organize and perform work related to the repair, renovation and maintenance of carpentry products,
- program and operate machines and devices used in the wood processing process, and prepare design, construction and technological documentation,
- performing work related to the operation and maintenance of machines and devices used in carpentry,
- carrying out repairs, renovation and maintenance of wood products and wood-based materials,
- organization and supervision of production processes related to wood processing in wood industry: furniture, sawmill, construction carpentry, production of wood materials, packaging, wood accessories and in centers for the design and marketing of wood products, performing tasks at technical and production positions, design or in laboratories.

EQF 5: WOOD TECHNOLOGY ENGINEER

Occupational competences:

The graduate knows and understands:

- basic issues in the field of biology of fibrous plants, general and materials chemistry, mathematics and physics with extended mechanics and thermodynamics,
- general issues regarding human functioning in the field of physiology and ergonomics of work and living organisms causing the degradation of materials used in wood technology,
- issues related to technologies, tools and materials used in solving engineering tasks in the field of wood,
- basic issues regarding processes occurring in the life cycle of devices, facilities and technical systems used in the wood industry,
- economic and legal knowledge and ethical knowledge adapted to the field of wood technology and knowledge of non-technical conditions of engineering activities,
- general issues regarding the role and importance of the environment and the changes taking place in it, as well as the basics of technology and shaping the environment, adapted basic concepts and principles of industrial property protection and copyright; is able to use patent information resources,
- general principles of creating and developing forms of individual entrepreneurship,
- basic management issues, including quality management, and running and creating a business.

The graduate can:

- search, understand, critically analyse and creatively use the necessary information from various sources and in various forms specific to wood technology,
- make a preliminary economic assessment of the proposed solutions,
- recognize their systemic and non-technical aspects, including ethical aspects,
- plan and conduct experiments, including measurements and computer simulations, using analytical and simulation methods and experimental, interpret the obtained results and draw conclusions,
- design, in accordance with given specifications, and produce devices, facilities, systems or implement processes, using appropriately selected methods, techniques, tools and materials,
- analyse the functioning and evaluate existing technical solutions, in particular devices, systems and processes in the field of wood technology, taking into account systemic and non-technical aspects, including ethical aspects,
- work independently or in a team, plan, organize work and cooperate with other people as part of team work, interpret the obtained results and draw conclusions,
- independently plan and implement their own lifelong learning.

The graduate is ready to:

- critically evaluate their knowledge and received content,
- identification and resolution of cognitive problems and practical, and is aware of the need to seek the opinion of experts in case of difficulties in solving the problem on their own,
- initiate activities in the public interest,
- take social, professional and ethical responsibility for wood production affecting the surroundings and the state of the natural environment, and understands non-technical aspects of engineering activities, including care about the achievements and traditions of the profession.

3. CIRCULAR ECONOMY, INDUSTRY 4.0 AND AMBIENT AND ASSISTED LIVING (AAL) SKILLS AND KNOWLEDGE THAT ARE ALREADY INCLUDED IN THE EXSISTED MODULES COMPARED TO THE PROPOSALS IN »PATHWAYS TO HE«

Procedure

We reviewed the modules included in Wood Technician and Wood Technology Engineer qualifications and then identified the skills and knowledge related to the Circular Economy, Industry 4.0 and AAL that are already included in the modules. These skills and knowledge were compared with those proposed in the Pathways to HE report. The results of the comparison are presented in the tables below. Skills and knowledge already included in the modules are highlighted in green and underlined.

EQF 4 - TECHNICIAN OF WOOD TECHNOLOGY

Table 1: EQF 4 – Technician of Wood Technology: Comparison of the Circular Economy skills and knowledge already included in the modules with those proposed in Pathways to HE.

Module	Circular Economy skills and knowledge already included in the modules	Circular Economy skills and knowledge suggested in »Pathways to HE«
Woodworking Techniques and Processes	Knowledge of products based on wood and wood-based materials in terms of wood protection procedures including ecological aspects such as hazardous waste in the timber industry, and need of responsibility towards a healthy environment.	• Eco Design • Cascading use • Natural resources management • Renewable energy sources • Efficient and sustainable productions • Environmental effects • Circular business models • Industry symbioses • System thinking implementation • Biorefinery • Green chemicals • Bio economy • Functional materials (sustainable composites, advanced materials) • LCA analyses • Collection and recycling • Transparency in supply chains • Hazardous chemicals • Green public procurement • Nano technology
Material Science and Properties of Wood	The student recognizes and knows the properties of wood species and wood-based materials (calculates the basic physical and mechanical properties of wood and wood-based materials, determines the type of wood in terms of meeting quality standards, dimensions and purpose). Also evaluates wood, wood-based materials and other materials in terms of defects and usability in order to select the appropriate material depending on the expected conditions of use.	
Machinery Operation and Maintenance	Learning to use the information contained in the operating instructions for machines and devices used in carpentry. The student selects the technology for producing products from wood and wood-based materials to the type of product being manufactured and its structure.	
Quality Control and Assurance	Learning to use appropriate standards and conformity assessment procedures when carrying out professional tasks.	
Technical Drawing and Design Principles	Learning to prepare sketches and technical drawings	
Health and Safety Practices	The student applies legal provisions regarding occupational health and safety, fire and environmental protection and uses technical means of individual and collective protection when performing professional tasks, and determines the effects of harmful factors on the human body.	
Environmental Sustainability and Regulations	The student identifies ecological equipment and materials used at work.	
Project Work and Practical Experience	The knowledge of the impact of change on various situations of social and economic life (indicates examples of introducing change and assesses its effects, suggests ways of solving problems related to the performance of professional tasks in unpredictable conditions).	

Table 2: EQF 4 - Technician of Wood Technology: Comparison of the Industry 4.0 skills and knowledge already included in the modules with those proposed in Pathways to HE

Module	Industry 4.0 skills and knowledge already included in the modules	Industry 4.0 skills and knowledge suggested in »Pathways to HE«
Woodworking Techniques and Processes	Learning of construction elements and their connections in accordance with technical documentation. The student selects the technology for producing products from wood and wood-based materials to the type of product being manufactured and its structure in modern wood manufacturing processes.	• Cross reality (VR, AR, MR) • Cloud computing • Online security • Internet of things (IoT) • Simulations • Autonomous (smart) robots • Big data • Additive productions -3D, 4D printing • Artificial intelligence
Material Science and Properties of Wood	The student classifies products made of wood and wood-based materials as well as knows advanced materials.	
Machinery Operation and Maintenance	Training in operating machines and devices used in the processing of wood and wood-based materials, selection the processing method according to the type of materials (setting parameters for manual and machine processing of wood and wood-based materials, determines the sequence of operations and activities in the processing of wood and wood-based materials), and designing production equipment for carrying out technological operations on products.	
Digital Design and CAD/CAM Software	Training in prepares and using machining program using the selected programming environment to implement the machining process using the local network.	
Quality Control and Assurance	Training with measuring instruments and gauges to assessing the quality of workmanship of products made of wood and wood-based materials. The student identifies wear rates, blunting criteria, and tool life.	
Technical Drawing and Design Principles	Training in operating computer programs supporting the production of carpentry products and uses construction and technological documentation.	
Environmental Sustainability and Regulations	The knowledge of professional information regarding industry from various sources.	
Project Work and Practical Experience	Training of uses computer programs supporting the production of carpentry products.	

Table 3: EQF 4 - Technician of Wood Technology: Comparison of the AAL skills and knowledge already included in the modules with those proposed in Pathways to HE

MODULE	AAL skills and knowledge already included in the modules	AAL skills and knowledge suggested in »Pathways to HE«
Woodworking Techniques and Processes	The knowledge of ergonomic design principles and user-friendly design in furniture or wood products, as and materials and their properties could contribute to creating furniture that aligns with AAL principles (using lightweight, durable, or adaptable materials).	• Smart buildings • Smart furniture • Ergonomic interior design • Sensors • Fire and other safety
Material Science and Properties of Wood	The student determines the type of wood in terms of meeting quality standards, dimensions and purpose.	
Machinery Operation and Maintenance	The student organizes the workplace in accordance with ergonomic requirements and regulations on occupational health and safety, fire protection and environmental protection.	
Quality Control and Assurance	The student recognizes appropriate standards and conformity assessment procedures that aligns with AAL principles to consider special needs.	
Health and Safety Practices	The student determines the effects of harmful factors on the human body, identifies preventive actions to prevent threats from occurring at the workplace, recognizes fire-threatening situations during work.	

EQF 5 – WOOD TECHNOLOGY ENGINEER

Table: 4: EQF 5 – Wood technology engineer: Comparison of the Circular economy skills and knowledge already included in the modules with those proposed in Pathways to HE

Module	Circular Economy skills and knowledge already included in the modules	Circular Economy skills and knowledge suggested in »Pathways to HE«
Materials Science and Technology	Knowledge in the field of biology of fibrous plants, general and materials chemistry, mathematics and physics with extended mechanics and thermodynamics to understand sustainable materials, eco-friendly wood treatment methods, and exploring innovative materials or composites with lower environmental impact. The students make the connection between the sustainability classes of solid wood and wood-destroying organisms as well as analyzes properties of materials and constructions in function of thermal insulation.	• Natural resources management • Renewable energy sources • Efficient and sustainable productions • Environmental effects • Circular business models • Industry symbioses

Process Optimization and Innovation	Usage patent information resources. Moreover, students learn to use different types of wood, understanding the kind of waste they produce after several processes.	• System thinking implementation • Biorefinery • Green chemicals • Bio economy • Functional materials (sustainable composites, advanced materials) • LCA analyses • Collection and recycling • Transperancy in supply chains • Hazardous chemicals • Green public procurement • Nano technology
Environmental Sustainability and Regulations	Learning of general issues regarding to human functioning in the field of physiology and ergonomics of work and living organisms causing the degradation of materials used in wood technology as well as regarding the role and importance of the environment and the changes taking place in it, as well as the basics of technology and shaping the environment, adapted basic concepts and principles of industrial property protection and copyright.	
Project Management and Leadership Life Cycle Assessment (LCA) Analyses	Training of: • basic management issues, including quality management, and running and creating a business; • general principles of creating and developing forms of individual entrepreneurship; • LCA analyses to evaluate the environmental impact of wood products and processes, aligning with Circular Economy principles.	

Table 5: EQF 5 – Wood technology engineer: Comparison of the Industry 4.0 skills and knowledge already included in the modules with those proposed in pathways to HE

Module	Industry 4.0 skills and knowledge already included in the modules	Circular Economy skills and knowledge suggested in »Pathways to HE«
Manufacturing Processes and Automation	Knowledge of issues related to technologies, tools and materials used in solving engineering tasks in the field of wood.	• Cloud computing • Online security • Internet of things (IoT) • Simulations • Autonomous (smart) robots • Big data • Additive productions - 3D, 4D printing • Artificial intelligence
Materials Science and Technology	Learning about the need for wood certification and the legal basis in this regard and basic issues regarding processes occurring in the life cycle of devices, facilities and technical systems used in the wood industry.	
Digital Design and CAD/CAM Software	Training in computer-aided design (CAD) and computer-aided manufacturing (CAM) software for digital modeling and process planning.	
Process Optimization and Innovation	Analyzing the functioning and evaluate existing technical solutions, in particular devices, systems and processes in the field of wood technology, taking into account	

	systemic and non-technical aspects, including ethical aspects.	
Quality Control and Assurance	Training of planning and conducting experiments, including measurements and computer simulations, using analytical and simulation methods and experimental, interpret the obtained results and draw conclusions.	
Digitalization and Smart Technologies	Learning of design in accordance with given specifications, and produce devices, facilities, systems or implement processes, using appropriately selected methods, techniques, tools and materials.	

Table 6: EQF 5 - Wood technology engineer: Comparison of the AAL skills and knowledge already included in the modules with those proposed in Pathways to HE

Module	AAL skills and knowledge already included in the modules	AAL skills and knowledge suggested in »Pathways to HE«
Materials Science and Technology	The knowledge materials used in furniture production might indirectly relate to AAL by considering factors such as durability, adaptability, and usability for individuals with specific needs.	• Smart buildings • Smart furniture • Ergonomic interior design • Sensors • Fire and other safety
Design Principles and Ergonomics	Taking social, professional and ethical responsibility for wood production affecting the surroundings and the state of the natural environment, and understands non-technical aspects of engineering activities, including care about the achievements and traditions of the profession.	
Quality Control and Assurance	Learning of efficient use of machinery to minimize waste, repair techniques to extend machinery lifespan, and getting knowledge of efficient production contributing to reducing environmental impact.	
Health and Safety Practices	Students learn about occupational health and safety; legal and ethical knowledge adapted to the field of wood technology and knowledge of non-technical conditions of engineering activities.	

4. A PROPOSAL TO COMPLEMENT EXISTING QUALIFICATIONS WITH CIRCULAR ECONOMY, INDUSTRY 4.0 AND AAL SKILLS AND KNOWLEDGE AT EQF 4 AND EQF 5 LEVEL IN THE WOOD AND FURNITURE SECTOR

Based on the review presented in the tables above, we have concluded that some Circular economy, Industry 4.0 and AAL skills and knowledge are missing and should be updated in the existing qualifications. While our list is not exhaustive, it highlights the urgent need to

integrate sustainable and digital skills and knowledge into VET educational and training programmes. These identified gaps are crucial for adapting our qualifications to the evolving needs of the modern workforce and expectations. By integrating these skills and knowledge, we aim to improve the relevance and applicability of our VET programmes, equipping learners with the essential skills they need to thrive in a rapidly changing global environment, particularly in the specialised wood and furniture sector:

EQF 4 – Technician of Wood Technology: CIRCULAR ECONOMY

- Cascading use
- Renewable energy sources
- Circular business models
- Industry symbioses
- Biorefinery
- Bio economy
- LCA analyses
- Transparency in supply chains
- Green public procurement
- Nano technology

EQF 4 – Technician of Wood Technology: INDUSTRY 4.0

- Cross reality (VR, AR, MR)
- Online security
- Autonomous (smart) robots
- Big data
- Artificial intelligence

EQF 4 – Technician of Wood Technology: AAL

- Smart buildings

EQF 5 - Wood technology engineer: CIRCULAR ECONOMY

- Renewable energy sources
- Circular business models
- Biorefinery
- Bio economy
- Nano technology

EQF 5 - Wood technology engineer: INDUSTRY 4.0

- Autonomous (smart) robots

Allview

Co-funded by the
Erasmus+ Programme