Mapping existing Industry 4.0 Learning Resources

Contents

Allview

N°1

Introduction

Task 2.2 deals with creation of database of the existing learning units and resources in the field of Industry 4.0 of Wood and Furniture sector.

Database of the project relies on the further use and classification of already existing learning ALLVIEW - Alliance of Centres of Vocational Excellence in the Furniture and Wood Sector EU-funded projects content like:

- IN4WOOD (Project reference: 575853-EPP-1-2016-1-ES-EPPKA''-SSA, duration November 2016 to October 2019),

- MAKING4.0 (Project reference: 598783-EPP-1-2018-1-ES-EPPKA2-CBHE-JP, duration November 2018 to November 2021)

- DITRAMA (Project reference: 601011-EPP-1-2018-1-ES-EPPKA2-SSA, duration January 2019 to December 2021)

IN4WOOD undertakes analysis the wood and furniture sector regarding the lack of knowledge and skills in Industry 4.0 and to develop complete and agile training paths. Based on this, the project team developed training materials for the most useful key enabling technologies of Industry 4.0 and a mobile based platform to access their content. Finally, a joint curriculum for the wood and furniture industry will cover and include the results.

DITRAMA instead aims to train the Digital Transformation Manager of furniture manufacturing companies. This person will be responsible for leading in an integrated way the digital transformation of all company departments. The suggested position requires technical and managerial skills, as well as knowledge of the sector. To reach this goal, the Group is designing a Curriculum for this occupational profile and a complete training course. The training materials are integrated in an open e-learning platform.

MAKING4.0 will establish a European-Malaysian collaborative consortium with the objective to develop an innovative master's degree for engineers of furniture smart factories that will modernize High Education degrees, by focusing on the ICTs skill needs to increase competitiveness of the wood and furniture industry of Malaysia.

All these projects contributed through ALLVIEW team to conception and compilation of the learning content.

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N°2

Data collection methods

For T2.1 and T2.2 tasks, draft for a guide was prepared to aid the partners in the WP2 activity, which means that it was not mandatory but recommendation to be followed.

Draft guide consisted of recommendations of where to search for data, like:

1. Existing partner's projects
2. Emerging partners' projects
3. Existing and emerging European and projects with developed materials, shared with Creative Commons Attribution-Share Alike 4.0 International License.
4. University Resources
5. Online courses
6. Partners' and European pages with reports and articles

It was recommended that search was performed both in English (if the site/material is also in this language) and in the native/s language/s of the participant's country, with special pressure put on terminology, as with a high specific trade, there could be some mistakes in the terminology, suggestions to find a dictionary in the language you are looking for or any other mean to check if the translations are valid were made.

Proposed materials:

1. Learning Units
2. Programmes – curricula
3. Online courses
4. Reports
5. Specific literature

Considering possible misunderstandings, a specific folder for each task in the MS Teams Files, inside the WP2 folder, for saving digital objects. It was recommended to name them with the same title as given in the Description Table, if it's not possible use abbreviation or change to English alphabet (problems with national letters are common).

Proposed description table of digital objects was discussed and agreed with WP1 leaders.

Table 1. Description table for digital objects in the database collection task

Title of the unit/document	**The title of the document**
Topic	field
Type of the document	
Language	
Date of creation	The date it was written
Title of the qualification	
EQF/NQF level of the qualification	
ECVET points	
Learning outcomes	
License type	Whether we can reuse it as a resource, or add as a reference only
Source	The institution or project that holds the digital object
Link	A permanent link to the exact webpage where the digital object is hosted (please make sure of the permanency, most of the times it's not valid to copy/paste the search bar. In most of the webs there is one already shown in the description)
Description	A brief description of the content of the digital object
Archive name/folder name	The name you are giving to the digital object
Media type (image, video, text, etc.)	
Institution responsible	The name of the partner
Keywords	4 or 5 keywords to describe the digital object
Relevance (contemporary, outdated etc)	

Allview

Nº3

Results

During efforts of searching with comprehensive course on Industry 4.0 in wood sector, it was concluded that developed database should also contain Ambient Assisted Living topics, as there is direct connection between the two, and could be useful in the T2.4 Development of AAL training materials.

Following AAL courses found by partners WULS-SGGW, ULUB, CENFIM, INNOVAWOOD, FCBA, CETEM, KIT.

Table 2. AAL Complete courses collected

No	Topic	Title	EQF	ECVET
1	E-literacy of elderly	Active aging and e-literacy of the elderly https://arhiv.acs.si/vabila/Dejavno_staranje_in_e-opismenjevanje_starejsih.pdf	n/a	n/a
2	E-literacy of elderly	Computer course https://www.doba.si/dogodki/racunalniska-delavnica-1	n/a	n/a
3	E-literacy of elderly	Subsidized courses for advanced computer work and greater personal work success https://racunalniske-novice.com/brezplacne-delavnice-za-naprednejse-delo-z-racunalnikom-in-vecji-osebni-delovni-uspeh/	n/a	n/a
4	E-literacy of elderly	Course - world of tech. with GOAP smart house https://www.e-hisa.si/kreativna-delavnica-svet-tehnike-s-pametno-hisko-podjetja-goap/	n/a	n/a

Table 3. AAL complete webpages collected

No	Topic	Title	Content
1	E-literacy of elderly	Computer literacy of older adults	Teaching eldery about basics of internet and ICT
2	E-literacy of elderly	Simbioza	They offer many group and individual gorm of non-formal education, which helps overcoming the fear of technology.
3	E-literacy of elderly	Digital literacy for adults Expert basis for program preparation	Development of professional materials, programs and approaches in innovative learning environments
4	E-literacy of elderly	Computer literacy of the eldery	The course was ment for teaching eldery basics of Windows, text editing and basics of Internet.
5	E-literacy of elderly	Computer literacy for employees - RPO	A course is designed for employees over 45 years of age and older who are new to the computer.
6	Smart home	Event for SRIP Smart Buildings and Home with Wood Chain	As part of the renewal of the Slovenian Smart Specialization Strategy (S4) for the programming period 2021-2027, SVRK is organizing online courses and the support of Strategic Partnerships (SRIP)
7	Smart home	Fibaro	Webiste of the company where they have displayed and described their products and solutions.

8	Smart home	VIA – Smart home – Connected Home	Presentation of their products and sofware for smart home.
9	Smart home	Smart home for everyone	Guide for DIY smart home.
10	Smart home	SHVET - SmartApp Network	SHVET brings together VET and HVET providers, research institutions, national agencies for VET and representatives of SMEs in order to deliver a new joint qualification between Croatia, Slovenia and Italy.
11	Blockchain	Delivering blockchain skills for Europe	CHAISE is a Sector Skills Alliance financed by the Erasmus+ programme. Our core mission is to develop a strategic approach on blockchain skills development for Europe as well as to deliver future-proof training solutions, in order to tackle blockchain skill shortages and to respond to the current and future skill needs of the European Blockchain workforce.

Following I4.0 courses (and eLearning platforms) found by partners WULS-SGGW, ULUB, CENFIM, INNOVAWOOD, FCBA, CETEM, KIT.

Table 4. Industry 4.0 courses collected

No	Topic	Title	Type	EQF	ECVET
1	VR / AR / MR / XR	Navidezna resničnost (Modul A) https://www.fe.uni-lj.si/en/education/1st_cycle_academic_study_programme/electrical_engineering/subjects/2009011210474545/	Complete blended learning course	6	5
2	VR / AR / MR / XR	Game technology and virtual reality https://www.fri.uni-lj.si/sl/predmet/63740	Complete blended learning course	6	6

3	Manag ement	EQ-WOOD - European Quality Qualification for the WOODwork and furniture industry https://www.eqwood.org/elearning	Com plete blen ded learni ng cours e	5	3
4	Manag ement	Innovation management systems http://making40.eu/index.php/przykladowa-strona/module4/	Com plete blen ded learni ng cours e	5	3
5	Furnitu re	Product Design and Digitalization http://making40.eu/index.php/przykladowa-strona/module1/	Com plete blen ded learni ng cours e	5	3

6	Manag ement	Technological surveillance and competitive intelligence. http://making40.eu/index.php/przykladowa-strona/module4/	Com plete blen ded learni ng cours e	5	3
7	Other specific	Additive Manufacturing http://making40.eu/index.php/przykladowa-strona/module1/	Com plete blen ded learni ng cours e	5	3
8	VR / AR / MR / XR	Augumented Reality http://making40.eu/index.php/przykladowa-strona/module1/	Com plete blen ded learni ng cours e	5	3

9	Manag ement	Digital Transformation in Industry 4.0 http://making40.eu/index.php/przykladowa-strona/module1/	Com plete blen ded learni ng cours e	5	3
1 0	VR / AR / MR / XR	Simulation and 3D Scannnig http://making40.eu/index.php/przykladowa-strona/module1/	Com plete blen ded learni ng cours e	5	3
1 1	Wood	Cloud Computing and Big Data applied to wood-based industry http://making40.eu/index.php/przykladowa-strona/module1/	Com plete blen ded learni ng cours e	5	3

1 2	Manag ement	Internet of Things http://making40.eu/index.php/przykladowa-strona/module1/	Com plete blen ded learni ng cours e	5	3
1 3	Genera l	Network Communications in the industry http://making40.eu/index.php/przykladowa-strona/module1/	Com plete blen ded learni ng cours e	5	3
1 4	Wood	Robotic applied to the wood-based industry http://making40.eu/index.php/przykladowa-strona/module1/	Com plete blen ded learni ng cours e	5	3

15	Manag ement	Wireless Technologies for logistic and manufacturing http://making40.eu/index.php/przykladowa-strona/module1/	Complete blended learning course	5	3
16	Genera l	Automation and mechanization. Low-Cost Automation http://making40.eu/index.php/przykladowa-strona/module1/	Complete blended learning course	5	3
17	Genera l	Management systems. Lean manufacturing. http://making40.eu/index.php/przykladowa-strona/module4/	Complete blended learning course	5	3

1 8	Wood	Materials for furniture manufacturing http://making40.eu/index.php/przykladowa-strona/module3/	Com plete blen ded learni ng cours e	5	3
1 9	Furnitu re	Materials Processing http://making40.eu/index.php/przykladowa-strona/module3/	Com plete blen ded learni ng cours e	5	3
2 0	Furnitu re	Production processes in the furniture sector. http://making40.eu/index.php/przykladowa-strona/module1/	Com plete blen ded learni ng cours e	5	3
2 1	Genera l	industrie 4.0 https://www.vdab.be/opleidingen/aanbod/O-AMI-800907/cursus/C-AMI-191221/Industrie_4_0-online	Com plete onlin e cours e	3	5

2 2	Furnitu re	Digital Transformation Manager https://ditrama.eu/en/training-course	Com plete onlin e cours e	5	2.8
2 3	Other specific	Industry 4.0 E-Learing Platform (Registration required): https://app.in4wood.eu/login	E- Lear ning Platf orm	EQF Level - 5	
2 4	Other specific	3D Printing and Additive Manufacturing for Furniture Manufacturing E-Learing Platform (Registration required): https://app.in4wood.eu/login	E- Lear ning Platf orm	EQF Level - 5	
2 5	Other specific	Augmented Reality and Intelligent Tools that may be Used During the Design and Fabrication of the Product E-Learing Platform (Registration required): https://app.in4wood.eu/login	E- Lear ning Platf orm	EQF Level - 5	
2 6	Other specific	Sensors and Wearables E-Learing Platform (Registration required): https://app.in4wood.eu/login	E- Lear ning Platf orm	EQF Level - 5	

2 7	Other specific	RFID/NFC E-Learing Platform (Registration required): https://app.in4wood.eu/login	E-Lear ning Platf orm	EQF Level - 5
2 8	Other specific	Robotics applied to furniture production at the different production stages E-Learing Platform (Registration required): https://app.in4wood.eu/login	E-Lear ning Platf orm	EQF Level - 5
2 9	Other specific	Simulation, modelling and virtualization in the design, virtual catalogues, 3D scanning E-Learing Platform (Registration required): https://app.in4wood.eu/login	E-Lear ning Platf orm	EQF Level - 5
3 0	Other specific	Internet of Things E-Learing Platform (Registration required): https://app.in4wood.eu/login	E-Lear ning Platf orm	EQF Level - 5
3 1	Other specific	Integrated Systems E-Learing Platform (Registration required): https://app.in4wood.eu/login	E-Lear ning Platf orm	EQF Level - 5
3 2	Other specific	Big Data & Analytics E-Learing Platform (Registration required): https://app.in4wood.eu/login	E-Lear ning Platf orm	EQF Level - 5

3 3	Other specific	Cloud Computing E-Learing Platform (Registration required): https://app.in4wood.eu/login	E-Learning Platform	EQF Level - 5
3 4	Other specific	Communication Networks E-Learing Platform (Registration required): https://app.in4wood.eu/login	E-Learning Platform	EQF Level - 5
3 5	Other specific	Cyber-Security E-Learing Platform (Registration required): https://app.in4wood.eu/login	E-Learning Platform	EQF Level - 5
3 6	Other specific	Collaborative Platforms E-Learing Platform (Registration required): https://app.in4wood.eu/login	E-Learning Platform	EQF Level - 5
37	Other specific	Applications of Logistics E-Learing Platform (Registration required): https://app.in4wood.eu/login	E-Learning Platform	EQF Level - 5
3 8	Other specific	Workflow Management Systems E-Learing Platform (Registration required): https://app.in4wood.eu/login	E-Learning Platform	EQF Level - 5

| 3 9 | Other specific | Standards Certifications and Legal Issues
E-Learing Platform (Registration required):
https://app.in4wood.eu/login | E-Learning Platform | EQF Level - 5 |

Other than complete courses within I 4.0, 7 reports and theses dealing with that subject were found.

Table 5. Reports and theses dealing with I4.0

No	Topic	Title	Description
1	VR / AR / MR / XR	Using VR technologies as marketing tools	Thesis is reasearching how is Slovenian market open for this kind of technologies.
2	VR / AR / MR / XR	Usability of virtual reality in construction industry	Thesis presents ways and technologies in the field of VR, which have potential applications in construction.
3	VR / AR / MR / XR	Virtual reality in automotive industry	Potential use of VR in the automotive industry.
4	VR / AR / MR / XR	Use of VR in education	Teachers report on using VR technology in class (what software and hardware did he use, students feedback and more).
5	VR / AR / MR / XR	Effects of the use of smart glasses on eyesight	Effects of using smart glasses on users comfort during order picking activities were researched in a testing environment.

No	Topic	Name	Description
6	VR / AR / MR / XR	Virtual and agumented reality technologies as tool for presenting new ideas and prodcuts at fairs: case MAHEPA	Paper is describing attempt to create a virtual presnetation of new hybrid aircraft.
7	VR / AR / MR / XR	Augmented reality as infrastructure for improvement of communication in construction projects	The thesis studies how to address this problem with Augmented Reality.

Also, 24 portals and webpages dealing with I4.0 in the furniture industry and other good practices were catalogued:

Table 6. Portals and webpages dealing with I4.0 in the furniture and related industry

No	Topic	Name	Description
1	Furniture	Virtual reality - into the magic	Company is using VR for customers trying out a variety of home furnishing solutions.
2	VR / AR / MR / XR	Marles 360° virtual tour	House building company is using VR, which allows customers to see and walk around their not yet build house and its rooms.

3	VR / AR / MR / XR	VR eyeglases and equipment: Ultimate guide about VR world	Guide about VR technology and equipment
4	VR / AR / MR / XR	TravelAR Slovenia	By co-creating and involving the local community, they strive to preserve and visualize the sights of local cultural heritage.
5	VR / AR / MR / XR	XR Slovenija	The Slovenian community of XR creators and its enthusiasts. Questions, Debates, Meetings … All about Xr!
6	VR / AR / MR / XR	Mobile game "Pokemon GO"	Pokémon Go is a free game for smartphones, which, works on the principle of augmented reality.
7	VR / AR / MR / XR	Mobile app. "Snapchat"	Lens Studio application designed for artists and developers, to build augmented reality experiences for users of their app. Snapchat.
8	VR / AR / MR / XR	Magic Leap 1	Their product can read a room in moments. It understands corners, edges and surfaces, so the apps can interact with your surroundings.
9	VR / AR / MR / XR	HoloLens 2	Mixed reality device with that enhance collaboration. Help your company be more productive and innovate with more purpose.

10	VR / AR / MR / XR	Workshop for virtual reality	A workshop on virtual reality was taken place in OpenLab. They learned the principles of virtual reality, modeling and programming.
11	VR / AR / MR / XR	Workshop for virtual reality	A workshop for vocational student was taken place. They created new virtual worlds and be able to play different roles
12	VR / AR / MR / XR	Digital UL - with innovative use of ICT to excellence	Develop innovative learning environments and introduce methods and pedagogical practices by integrating new technologies
13	VR / AR / MR / XR	Smart Augmented and Virtual Reality Marketplace for 14Furniture Customisation	The FurnIT-SAVER project will solve some problems making the use of virtual and augmented reality technologies, recommendation engines based on artificial intelligence and ecommerce solutions to produce a smart marketplace for furniture customisation.
14	Furniture	Tylko app.	See your shelf live in your space before you decide to buy it. Edit size, height and style on the fly. Furniture shopping with the powerful Tylko app always means a perfect fit.
15	Furniture	Virtual tour of showroom	Discover the latest King Living designs and luxury materials, learn about the benefits of King Living's steel frame and shop the full collection, all from the comfort of your home.

16	Furniture	IKEA Place	Spark ideas to create a better life at home. IKEA Place lets you virtually place true-to-scale 3D models in your very own space. Combining the latest AR technology and IKEA's smart home solutions you can experience IKEA like never before
17	Furniture	Myty	MYTY, the most powerful AR decoration tools to redesign your home. Redecorate your interior, enjoy thousands of inspirational images and test the furniture of your favorite brands, easily with your smartphone.
18	Furniture	Summit furniture	Summit offers 3D virtual tour of their showrooms.
19	VR / AR / MR / XR	Interior define	Interior defines app. let customer virtualy place their products 3D models into their own space.
20	Furniture	3D Product Visualization Made Easy	The 3D product visualization platform for furniture. Create Photorealistic Content at Scale. Product images and 3D content for a delightful shopping experience.
21	VR / AR / MR / XR	All-in-One Augmented Reality System	The ViewAR System lets developers, and inexperienced creators, use cutting-edge AR technologies to create immersive AR experiences across a broad range of domains

22	Furniture	The Virtual Experience Company	Nextech AR Solutions is a leader in web based augmented reality for ecommerce, advertising and virtual events with technology ranging from simple 3D Images to complex holograms.
23	Furniture	The Future of Furniture Retail	Allow customers to preview your furniture in their home with Augmented Reality. Improve purchase confidence and increase sales.
24	Furniture	The platform for 3D and augmented reality product visualization	Easily deploy mobile augmented reality solutions for eCommerce, field sales, education and more.

Allview

N°4

Content

Industry 4.0 is a fashionable widely developed topic, accompanied by numerous training courses, books, reports, and all sorts of webpages. Basically all industries are at point of implementing I40, changing distribution channels, sales methods, and work ways, in order to stay on the competitive market. Wood and furniture industry, being probably one of the most traditional of all, rushes after leaders, using new technologies and taking inspiration from other manufacturing industries.

Main challenge was to pick resources which are:

- Free
- Systemizing of existing knowledge
- Applicable to wood and furniture industry
- Applicable in HE and VE studies

Resources coming from the existing projects (especially courses) should be treated as most valuable, because as a standard these are conforming to the above requirements. Additional value of these is that selected resources are systemizing existing knowledge, keeping in mind the applicability in Higher Education and Vocational Education study programmes and in target sector companies.

Mentioned project resources and especially courses are coming from wide educational and professional market surveys.

Making 4.0 courses aco came to life from numerous surveys within European and Asian region, summerized in the report "Report of gaps and needs of the Malaysian HE and Industry in comparison with Europe" and developed Joint Curriculum with all results available for download from Materials section (*http://making40.eu/*)

In4Wood , with its "Report on the need of the Furniture Industry" resulting in "In4Wood Training Path and Learning Content" and "In4Wood Common Curriculum Proposal" came from surveys and consultation of furniture manufacturers, VET/HE communities, KETs experts, available for review on the webpage (*https://in4wood.eu/public-documents/*)

Ditrama project, with its "Guide for the Digital Transformation Manager (DTM) for the Furniture Sector" also deals with found gaps basing on surveys within interested parties, and resulting in curriculum "Joint Curriculum Digital Transformation Manager" and digital transformation course, ovelapping with circular economy with addon modules, available for review on the project webpage (*https://ditrama.eu/en/downloads*)

EQ-Wood tackles innovation capacity and competitiveness of EU wood and furniture industry by designing and delivering the curriculum of Innovation Advisor in the Wood and

Furniture Industry. All data and resources of introduced innovation by merging green, digital and marketing skills and provide learners with specific competences required by the sector evolution in Europe and finally curriculum and materials of Innovation Advisor in the Wood and Furniture Industry came from surveys and analysis available for download from the project webpage (*Eq-Wood I Downloads (eqwood.org)*)

Reassuming, all these mentioned and other listed **free resources** developed within last five years, were based on documented surveys, expert panels and cooperation with industry. These resources, as fully documented should be regarded as a comprehensive and contemporary, with easy to pick modules and even full courses and suggested listed literature (not always free) regarding educational institution or entrepreneurial neeeds.

Considering knowledge offered, available list of modules is enormous, partly overlapping due to the different writing style and definitions, lets try to reassume offer in some keypoint areas, derived mostly from Ditrama's Guide for the Digital Transformation Manager (DTM) for the Furniture Sector :

Table 7. Availability of key point areas in the discovered materials

No	Topic	Availabiliy
1	Introduction to I4.0	Available,numerous times, including full course on the basics of Industry 4.0
2	Internet of Things	Available, 2 full courses and several occurences in modules
3	Cloud computing	Available, 2 full courses and several occurences in modules
	Systems integration, ERP etc.	Available, 2 full courses (one dealing with bioeconomy) and several occurences
	Design software	Available, several times as a subtopic

Additive manufacturing	Available, 2 full modules and several occurences as a subtopic
Robots	Available, 2 full modules
Simulation and virtual prototyping	Available, 2 full modules and several as a subtopic
Virtual Reality, Augumented Reality	Available, 2 full courses
Data management	Available, full course
Data security	Available, one full course, several subtopics
Digital business models	Available, whole platform plus several occurences, some in connection with bioeconomy
Innovation&creativity	Available, 3 courses
Leadership in digital transformation	Available, 2 times
Communications, digital marketing	Available, 2 whole courses
Quality management	Available, 3 times
Implementation of digital strategy	Available, 3 times
Standarization	Available, whole module
Social and environmental impact of digital transformation	Available, numerous times

Within the Allviev project, Industry 4.0 seems covered well, especially all topics are covered at least with the whole module. In case of unlikely gaps, sufficient resources can be quite easily found, regarding availability of courses and the literature in external databases.

Additional Ambient Assisted Living topics and courses found will be useful in the T2.4 Development of AAL training materials

N°5

Summary

At this point, it is clearly visible that Industry 4.0 topic is practically covered in terms of I 4.0 for Furniture and Woodworking, available to the public, with all proposal-mentioned projects, 39 full courses, 7 reports/theses and 24 portals dealing with the subject.

Industry 4.0 became a popular and highly funded topic, both in private and public sectors. Available contents and materials are numerous and high quality, especially considering number of projects, institutions and scientists involved in the area. All assumed resources were gathered into database, dealing with the subject, and showing contemporary state of the art nature.

Due to the challenging time and continuous delivery of online resources, like communication, reports, articles education resources assumed to be utilized within the T2.2 work package it suggested to leave data collection open, with periodic updates, and utilization of external resources to save workload.

Attached documents:

1.   WP2 ALLVIEW Search Guide
2.   WP2 ALLVIEW Learning resources database