IN4WOOD

Industry 4.0 for Wood and Furniture Manufacturers

Deliverable 2.1.: Training Path and Learning Content
Version 1

Lead Beneficiary: CETEM
Approved by: All Consortium
Dissemination Level: Public

Partners

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Prepared	Verifed	Approved
CETEM	All Partners	All Partners

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Table of Track Changes

Version	Date	Changes
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Table of Contents

1. Executive summary....4
2. Methodology....6
3. Definition of Training Units....8
4. Definition of the didactic materials....8
5. Assessment of the learning outcomes....8
6. Design and organization of training paths....9

Annex 1: In4Wood Training Content.
Annex 2: Interrelation of the Key Findings from the Skill Needs Analysis and the Selected Units.
Annex 3: In4Wood Training Path for VET Students of Furniture and Woodworking related programmes.
Annex 4: In4Wood Training Path for HE Students of Furniture and Woodworking related programmes.
Annex 5: In4Wood Training Path for CEOs from furniture and woodworking industries.
Annex 6: In4Wood Training Path for Production Managers from furniture and woodworking industries.
Annex 7: In4Wood Training Path for VET students from ICT-related programmes.
Annex 8: In4Wood Training Path for HE students from ICT-related programmes.

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1. Executive summary

Background

Many observers believe that Europe is at the beginning of a new industrial revolution, considered to be the fourth such leap forward and hence labelled Industry 4.0. The ubiquitous use of sensors, the expansion of wireless communication and networks, the deployment of increasingly intelligent robots and machines (as well as increased computing power at lower cost and the development of 'big data' analytics) has the potential to transform the way goods are manufactured in Europe.

This new, digital industrial revolution holds the promise of increased flexibility in manufacturing, mass customization, increased speed, better quality and improved productivity. However, to capture these benefits, enterprises will need to invest in equipment, information and communication technologies (ICTs) and data analysis as well as the integration of data flows throughout the global value chain.

The EU supports industrial change through its industrial policy and through research and infrastructure funding. Member States are also sponsoring national initiatives such as *Industrie 4.0* in Germany, "*Industria conectada 4.0*" in Spain, the *Factory of the Future* in France and Italy, and Catapult centres in the UK. However, **challenges like training** workers and future professionals **remain**.

One quarter of the world´s furniture is produced in the EU. In 2012, more than 900.000 EU workers were employed in approximately 126.000 firms, and production amounted to more than €84 Billion[1]. However, these figures are 13% lower than in 2007, while the Asian market has increased its production a 230% during the same period[2]. In this context, the implementation and transference of the state of the art technologies in the production chain is a crucial point for the European Furniture and Woodworking industries to remain competitive, coupled with the fact that Staff qualifications, along with the ageing workforce and the inability to attract young workers[3] remain one of the crucial points in these industries. To boost the recruitment of highly prepared staff requires initiatives addressing training to make the sector attractive and to transform both the academic knowledge and high-level basic and transversal competences to be useful and applicable.

The furniture and wood sector has identified that it has a shortage of professionals with high qualification in ICTs and other emerging technologies. Some of the specific skills and competencies that stand out as critical for managers in the furniture sector are ICTs skills that are crucial to operate in a modern business environment.[4]

[1] (Eurostat SBS Eurostat, (sbs_na_ind_r2).
[2] CSIL processing data from official sources: Eurostat, UN, National Statistical Offices, National Furniture manufacturers associations.
[3] EFIC (2012) Enhancing the competitiveness of the European Furniture Industry.
[4] Investing in the Future of Jobs and Skills. Scenarios, implications and options in anticipation of future skills and knowledge needs. Sector Report. Furniture. European Commission, DG Employment, Social Affairs and Equal Opportunities.

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This deliverable detail the learning content proposed by the VET providers of the IN4WOOD Skills Alliance for addressing the skills and competences mismatches of the identified target groups.

With the elements that comprise the learning content, a training path for each one of the target groups identified has been designed in terms of the necessary areas of knowledge and optimized to fit the variety of job profiles and their needs. With this, the second milestone of the In4Wood project, *Training path Designed,* has been achieved.

This will define the content of the Joint Curriculum and will set the main guidelines for development in WP3.

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2. Methodology

For the definition of training units and learning outcomes, it was followed the *Learning Outcomes approach,* considering the four main modules of the In4Wood content as Units of Learning Outcomes (here after Units).

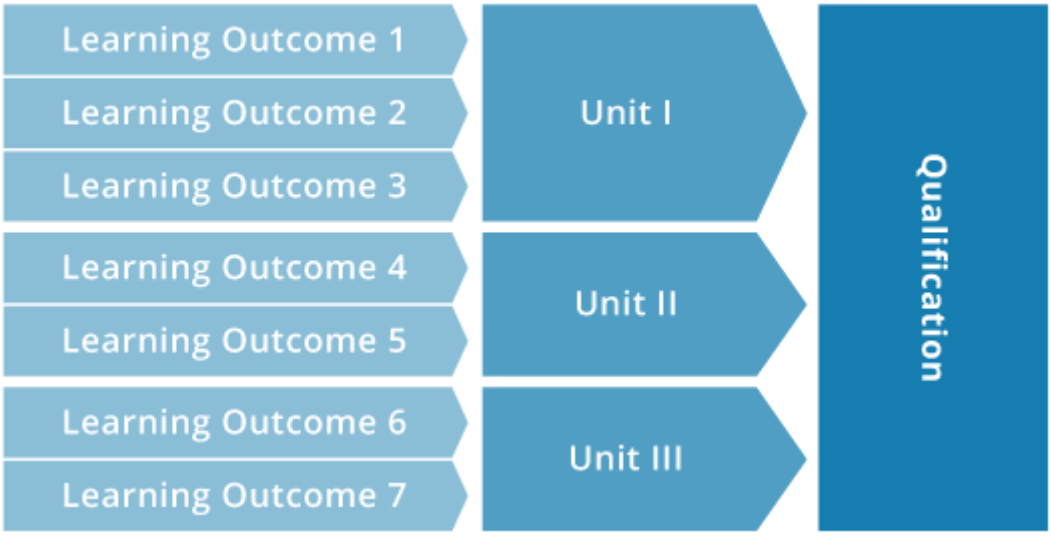

Figure 1: Description of qualifications in terms of units of learning outcomes. Source: http://www.ecvet-toolkit.eu

An Unit is a part of a qualification comprising a set of Knowledge, Skill and Competence that are logically structured and can be evaluated and validated. While preparing the proposal, partners designed the four different In4Wood units, being independent from each other and avoiding redundancies among them.

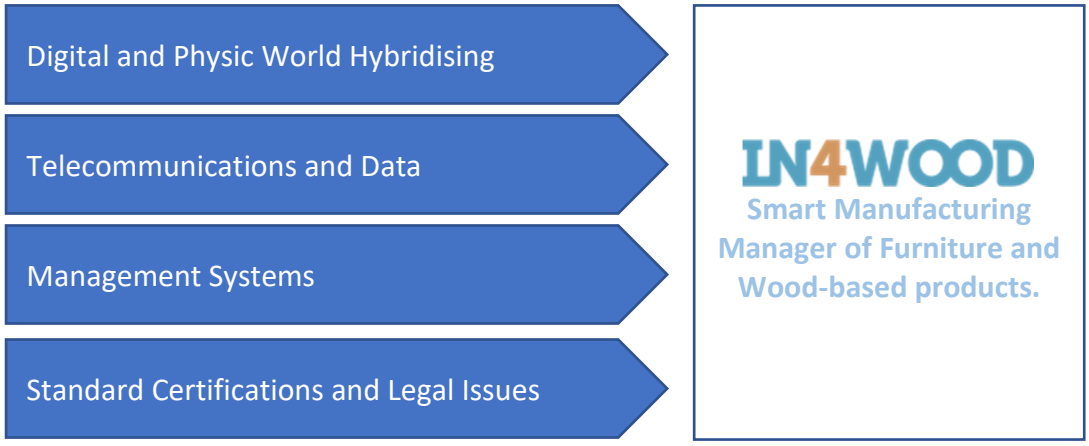

Figure 2: In4Wood Units.

It is in Task 2.1 *Definition of Training Units and Learning Outcomes* when these units are broken down into learning outcomes. These learning outcomes are statements of what a learner knows, understands and is able to do on completion of a learning process. The definition of learning outcomes has been carried out in such a way that:

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- All skills and competences needs identified in WP1 have been reflected.
- No unnecessary training is included.

Each partner has focused on the definition of the units that are closely related to their expertise and have provided feedback to others, creating a collaborative environment. Breaking down the main units into smaller and more manageable training sub-units and sections.

Digital and Physic World Hybridising	Telecommunications and Data	Management Systems	Standard Certifications and Legal Issues
•**KIT** •UPCT •CSM •SSSA	•**INDRA** •UPCT	•**CETEM** •ION	•**UPCT** •CETEM

Figure 3: Leaders and contributors of In4Wood units.

Each unit was fully described following ECVET recommendations, such descriptions are fully detailed in D2.2 *Common Curriculum Proposal.*

The training path procedure defines and analyses the necessary areas of knowledge and pedagogical approaches to address the specific needs of the different target groups of the In4Wood didactic content. Considered as the chosen route taken by a learner through a range of (commonly) e-learning activities, it allows users to build their knowledge progressively. For their development, the most suitable sub-units sections have been interconnected for each target group, ensuring that all target groups needs are satisfied and that that no unnecessary training is received.

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3. Definition of Training Units.

The results from the definition of skills needs[5] evidenced the consistency of the learning branches and helped to break down such units into smaller and more manageable sub-units. Such sub-units, were also broken down into different sections. This approach allows a better tailored training path and avoids unnecessary training for each one of the target groups.

Figure 4: In4Wood´s learning Units.

Coordinated by CETEM, the most suitable sub-units and their related sections were defined. Figure 3 shows the leaders and collaborators of each one of the In4Wood´s units. Annex 1 shows the defined sub-units and sections for each one of the units, while Annex 2 shows an inter relation of the key findings from the previous skills needs analysis and the selected units.

4. Definition of the didactic materials

In4Wood consortium commonly agreed that the best and most promising way of applying Training curriculum to the Target Users is through an Online basis, which means that all of the forthcoming presented Module are going to be in this way.

The main part of the In4wood didactic content will be released through the video pills, however, further additional content will be delivered that will support the different sub-units and that will be available through the learning platform, they will be mainly text, slides and tests. The common curriculum proposal released in D2.2 details the selected training format and specifies the minimum knowledge requirements for each unit:

- Practice works, to be developed at the different units, where students will have to do some research, analysis, practices etc., in a specific subject.
- Multiple choice questionnaires.
- The development of a Student Project where learners will have the chance of proposing solutions for transforming traditional Furniture and Woodworking industries into smart. Such student will be monitored and evaluated by the developers of the didactic content.

5. Assessment of the learning outcomes.

The assessment methodology will comprise three different tools with which the learner will be able to assess their knowledge, skills and competences acquired all along the learning process:

[5] See Deliverable D1.2 “Report of the need of the furniture industry regarding I4.0 KETs”.

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6. Design and organization of training paths.

During the proposal preparation stage, the In4Wood alliance defined six well differentiated target users of the In4Wood didactic programme.

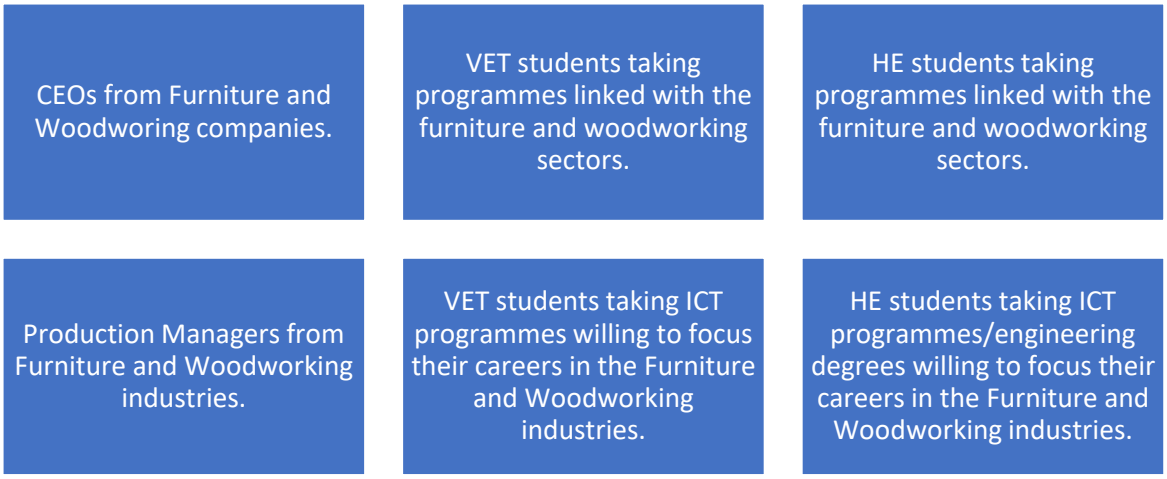

Figure 5: In4Wood´s target users.

This point details the profile of each different user.

CEOs from Furniture and Woodworking companies.

Persons engaged in the managerial part of these industries, mainly SMEs, in charge of overseeing and supervising the activities and employees. Small businesses rely on the CEO to keep workers aligned with the goals of the company. In Larger Enterprises, CEOs report to top executives, but in case of SMEs, the CEO might either own the company or report directly to the owner.

In furniture and Woodworking SMEs, CEOs oversee whether the day-to-day operations of the whole company or an individual department, such as marketing, sales or production.

No specific occupations for CEOs for furniture and woodworking industries have been identified when preparing this document, however it was identified a general occupation: *Chief Executive Officer*[6].

Production Managers from Furniture and Woodworking industries.

The responsibilities of the production managers from the targeted industries depend on the size of such industries. For the case of medium and large enterprises, the production managers monitor and supervise the entire production process to ensure that appropriate working practices are followed and the production needs of the company and customers are met, controlling all production steps and being responsible for compliance, regulations and targets.

[6] http://data.europa.eu/esco/occupation/6c3fd65e-2d24-47d8-bc22-9e93512bdcc2

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However, for the case of small and family businesses, the production managers are in charge of further activities related to planning, warehousing, maintenance and/or customer support.

The ESCO occupation *Wood Factory Manager*[7] was the only specific occupation identified during the preparation of the present document that covers the profile of the production manager of the targeted industries. The ESCO occupation *Manufacturing Manager*[8] was also identified as general occupation for this target group.

VET students

A VET student is someone who is enrolled in a degree-granting program (either undergraduate or graduate) at an institution of higher learning and registered full-time or partly (VET) leading to skills and competences to be further developed in a specific workplace. VET students identified as target users of the In4Wood content are those involved in educational programmes linked with whether the furniture and woodworking sectors, or with ICT.

HE students

Students enrolled in EQF6-7 degrees programmes addressing subjects such as production, engineering, industrial planning or ICT.

After the definition of the sub units and sections from each learning branch, Unit leaders and participant partners selected the most suitable sections for each target users.

Partners worked closely at the implementation of the Training paths, having a fluent communication through email, slack, conference meeting and during the 2nd and 3rd consortium meeting held in April and November 2017 respectively. As result, 6 different training paths has been defined. Annexes, 3, 4, 5, 6, 7 and 8 details the training paths for the target users define

[7] http://data.europa.eu/esco/occupation/b633af32-c8c0-4481-9971-7932ea4b16b5

[8] http://data.europa.eu/esco/occupation/6426ada1-4d8c-4612-99e3-91bc569805ee

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Title of the Unit:	Digital and Physic World Hybridising	
Sub Units	**Sections**	
3d Printing and Additive Manufacturing for Furniture Manufacturing.	Introduction to 3D printing and Additive Manufacturing	What is 3D printing?
		A brief description of 3D printing.
		Main materials for 3D printing
		Workflow: How 3d printing works?
		Production process in 3D printing
		A brief description of the main software used in 3D printing
	Application of 3D printing in the Furniture sector	Design and Prototyping
		Molds for Prototyping and final products
		Final products. Batches if size 1 up to X
	Commercial Aspects	
Augmented Reality and Intelligent Tools that may be Used During the Design and Fabrication of the Product.	Introduction to Augmented Reality	What is Augmented Reality?
		Differences between AR and Virtual Reality
		Workflow: How AR works?
		A Brief Description of some software used in AR
	Application of the Augmented Reality during the design and fabrication stage of the product.	Design and prototyping
		Production process
		Picking
		Maintenance
		Training for Workers
	Augmented Reality in the Commercial Market	
Examples of Performance Activities Developed in BLM department or Dissemination.	Example 1	
	Example 2	
	Example 3	
	…	
	Example n	
	Introduction	Definition
		Context in the Industry/Companies

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Title of the Unit:	Digital and Physic World Hybridising	
Sub Units	**Sections**	
Sensors and Wearables	Main Characteristics	
	Types	Smart Sensors
		SCADA
		Wireless Sensors & Networks
		MEMS/Nano sensors
		Energy Harvesting
		Summary of types of sensors and wearables
	Use Cases	
	Business Success stories	
	Future of Sensors and Wearables in Industry	
Robotics applied to furniture production at the different production stages	Introduction	Design principles for I4.0
		Introduction to Cyber Physical Systems
	Definitions and Concepts	From Industrial robotics to collaborative robotics
		Robotics and Artificial Intelligence
		Embedded systems
		Internet of Intelligent Robotics Things
		Cloud Robotics
	Use cases	Examples and case studies
		Applications in furniture manufactures
		Business models
	Practical exercises	Robotic Operating System (ROS)
		Cloud platforms (Azure, Amazon, …??)
Simulation, modelling and virtualization in the design, virtual	Introduction	Main objectives and focus of virtualization in the furniture/interiors sector
		Why? Enhancement of market competitiveness thanks to the correct use of tools
	Main Concepts	Approach to simulation, modelling, render and virtualization
		Panorama of existing tools, technologies and software
		How to select the most appropriate tool for specific purposes

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Title of the Unit:	Digital and Physic World Hybridising	
Sub Units	**Sections**	
catalogues, 3D scanning.	Examples and good practices	Case studies: focus on furniture/interiors SMEs
	Practical exercises: 3DS MAX	Preview and introduction (general notions about display windows, views, use of standard navigation methods, selection methods, grouping, setting up unit of measurement...)
		Transformation commands
		Creation of primitive and composite objects
		Edit Commands and modifiers
		Importing files with other extensions
	Practical exercises: CORONA RENDERER	Main Features of the Corona Renderer module (introduction to the Photography and light behavior in reality and within the render engine, set up of Corona as default rendering engine of 3ds Max)
		Materials, "Material Editor". Set a standard material (Corona Mtl), how to apply the texture on the material (UV and Tiling)
		Settings, "Render Setup" windows. Workflow optimization
		Set reflections and refractions, adjust the distribution of light on the surface through Glossiness, Bump effect and its uses
		Concepts of lighting technology (creation and alteration of lights (Corona light), uses and Color temperature properties, creation of photographic setups for "Still Life" of objects of design (with Limbo Fotografico), import of files containing lighting information IES
		Camera placement (creation and editing of Standard Camera or Corona Camera, add camera's effects such as field blur (DOF) in post- production

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Title of the Unit:	Telecommunications and data	
Sub Units	**Sections**	
Internet of Things	Introduction to I.o.T	What is IoT?
		Related Concepts
		How does IoT work?
		Application of IoT
		Commercial Aspects
		Concerns (privacy, security, health, etc.)
	Features of IoT	Architecture
		Intelligence
		Automation
		Design
	Technologies of IoT	The Cloud
		Wired and wireless networks
		Cyber-physical systems
		Technological Standards
	Technologies related to IoT	Computational Semantics
		Rule Engines
		Big data and Analytics
	IoT framework: SOFIA2	The SOFIA2 environment
		Defining your architecture
		The SOFIA2 Console
		Connecting to the SIB
		Creating your own KP
		The information producer
		Rule definition
	Can you build your own IoT environment?	Test 1: Set up the server
		Test 2: Build the clients
		Test 3: Connectivity
		Test 4: Intelligence
		Conclusions
Integrated Systems	Theoretical aspects	Complexity theory
		Networks in complex systems
		Legacy and path dependency
		Convergence and divergence
		Synergy, adaptation and evolution

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Title of the Unit:	Telecommunications and data	
Sub Units	**Sections**	
	Architecture	The service economy
		Service-oriented architecture
		Event-oriented architecture
		Modularity and self-organization
		System ecology
	Implementation	Middleware for distributed applications
		Integration topologies
		Integration challenges
Big Data & Analytics	Big data theory	Big data fundaments
		Big data platform
		Big data methodology
		Use cases and added value
	Big data technologies	Big data technologies I
		Big data technologies II
	Using big data	Data access
		Administration and data structures
		Advanced programming
	Analytics	Analytics fundaments
		Patterns, relationships and predictive modeling
		Data manipulation and machine learning
		Analytics technologies
Cloud Computing	Introduction	Definition
		Context in the Industry/Companies
		Main Characteristics
	Models of Cloud Computing	Infrastrucure as a Service (IaaS)
		Platform as a Service (PaaS)
		Software as a Service (SaaS)
		Emerging models
		Summary of CC models
	Deployment models	Public
		Private
		Hybrid
		Community
		Summary of deployment models

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Title of the Unit:	Telecommunications and data	

Sub Units	Sections	
		Advantages and disadvantages of Cloud Computing
		Business success stories
		Future of Cloud Computing in Industry
Communication Networks	Introduction	Definition
		Context in the Industry/Companies
	Industrial Communication networks (description and examples)	Body Area Networks (BAN): NFC, Bluetooth Low Energy, Bluetooth 4.0
		Personal Area Networks (PAN): Bluetooth, Zigbee.
		Local Area Networks (LAN): Ethernet, Industrial Ethernet, Rofbus, Profinet, M-Bus
		Wide Area Networks (WAN): GPRS, UMTS, LTE.
		Summary of Industrial communication networks
	Industrial Communication Standards	OPC UA
		Power Link
		Open Safety
		TCP/IP
		Summary of Industrial communication standards
	Use Cases	
	Business Success Stories	
	Future of Communication Networks in Industry.	
Cyber-Security	Introduction	Definition
		Context in the Industry/Companies
	Types	User & Password
		Fingerprint
		Face Recognition
		Cryptography
		Federation
		Summary of cyber-security strategies
	Evaluation	Pentesting (Penetration testing
	Use Cases	
	Business Success Stories	
	Future of Cyber-Security	

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Title of the Unit:	Management Systems

Sub Units	Sections	
Applications of Logistics	Warehouse management systems	Introduction
		Warehouse Activities
		Factors that influence the effective use of warehouses
		Types of Warehouse
		Design and Distribution in Plant
		Definition and Characteristics SGA
		Relationship of the SGA with the Value Chain
		Recommendations SGA Implementation
	Inventory management and DRP (Distribution Resource Planning)	Introduction
		Types of Inventories
		Types of Demands
		Inventory Cost
		FIFO and LIFO
		ABC Classification
		DRP Definition
		DRP Relationship with the Value Chain
		DRP Techniques
		DRP Safety Inventory
	Table of Board of KPIs (Key Performance Indicators)	Introduction
		KPI Types
		Characteristics, how they must be
		KPI Incidence in Continuous Improvement
		Implementation and Follow-up Industry Furniture
	Data capture systems for plant processes control (RFID: Radio Frequency Identification,)	Definitions
		Types of RFID
		How does it work?
		Uses and Implementation Industry Furniture
Workflow Management Systems	APP (Aggregate Production Planning) and Capacity control and Capacity Requirement Planning	Strategic Planning
		Production Planning
		PAP Production Aggregate Plan: Definition, Characteristics and Application Example Industry Furniture
		Capacity Requirement Planning: Definition, Characteristics and Application Example Industry Furniture
		Tactical Planning

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Title of the Unit:	Management Systems

Sub Units	Sections	
	MPS (Master Production Schedule) and MRP II (Manufacturing Resource Planning)	Master Production Plan: Definition, Characteristics and Example of Application
		Material Requirement Plan: Definition, Characteristics and Example of Application
	ERP (Enterprise Resource Planning)	Definition and Characteristics
		Types of ERP
		Uses and Implementation Industry Furniture
	Lean Manufacturing (workflow and improvement of manufacturing operations)	Introduction
		Basic Lean Tools
		Advanced Lean Tools
		Examples Application Industry Furniture
Collaborative platforms	B2B (Business to Business) B2C (Business to Consumer) C2C (Consumer to Consumer)	Identification of partners current mechanisms for B2B, B2C and to enable C2C communication.
		Research into best practice and most successful cost-effective options for B2B, B2C and C2C communication.
		Recommendation of possible Platforms along with aggregation recommendations to include data from current partners' approaches
	U2B (University to Business)	Identification of partners current mechanisms for U2B communication.
		Research into best practice and most successful cost-effective options for U2B communication.
		Recommendation of possible Platforms along with aggregation recommendations to include data from current partners' approaches
	U2S (University to Student) S2S (Student to Student)	Identification of partners current mechanisms for U2S and to enable S2S communication.
		Research into best practice and most successful cost-effective options for U2S and S2S communication.
		Recommendation of possible Platforms along with aggregation recommendations to include data from current partners' approaches

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Title of the Unit:	Standards, certifications and legal issues

Sub Units	Sections
Introduction to standardization	Definition
	Context in the industry/companies
	Why is standardization is an important issue?
State of art/challenges in standardization in I4.0	
Consortiums and organisations	IEC/ISO
	IETF/W3C
	DKE/DIN
	ETSI/CENELEC/CEN
	Summary of consortiums and organisations
Working Group Committees	CyberSecurity, industrial networks
	Automation Systems and Integration
	Robots and Robotic devices
	Sensor Networks
	Internet of Things
	Big Data
	Cloud Computing and Distributed Platforms
	Summary of working group committees
Standards focused on Wood and Furniture Sector	
How to apply standards to factories interested in Industry 4.0	
Legal issues in Industry 4.0	

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Unit	Sub-Unit	*Training programs with a blended learning formula should be focused on…*					*companies in Germany are much more focused on the application of KETs in the production process with attention to automation and robotics*	*SMEs in UK and Spain have a higher focus on the entire manufacturing process including logistics and delivery*	*SMEs in Italy are concentrated on the application of KETs to other processes (marketing, sales and after sales) than the production one.*	*Results evidence a lack of digital business strategy among furniture industries, specially SMEs, showing also a poor involvement in the IoT and in the use of cloud solutions.*	*The biggest barrier for the implementation of I4.0 in all these contexts is the lack of knowledge and skills among staff, along with an insufficient training and the high costs of said technologies.*
		Additive Manufacturing	Augmented Reality	Systems Integration	Internet of Things	Robotics					
Digital and Physic World Hybridising	3d Printing and Additive Manufacturing for Furniture Manufacturing.										
	Augmented Reality and Intelligent Tools that may be Used During the Design and Fabrication of the Product										
	Examples of Performance Activities Developed in BLM department or Dissemination.										
	Sensors and wearables										
	Robotics applied to furniture production at the different productions stages										
	Simulation, modelling and virtualization in the design, virtual catalogues, 3D scanning.										
Telecommunications and data	Internet of Things										
	Integrated Systems										
	Big Data & Analytics										
	Cloud Computing										
	Communication Networks										
	Cyber-Security										

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Unit	Sub-Unit	*Training programs with a blended learning formula should be focused on…*					*companies in Germany are much more focused on the application of KETs in the production process with attention to automation and robotics*	*SMEs in UK and Spain have a higher focus on the entire manufacturing process including logistics and delivery*	*SMEs in Italy are concentrated on the application of KETs to other processes (marketing, sales and after sales) than the production one.*	*Results evidence a lack of digital business strategy among furniture industries, specially SMEs, showing also a poor involvement in the IoT and in the use of cloud solutions.*	*The biggest barrier for the implementation of I4.0 in all these contexts is the lack of knowledge and skills among staff, along with an insufficient training and the high costs of said technologies.*
		Additive Manufacturing	Augmented Reality	Systems Integration	Internet of Things	Robotics					
Management Systems	Application of Logistics										
	Workflow Management Systems										
	Collaborative platforms										
Standards, certifications and legal issues	Introduction, state of the Art and challenges in Standardizations										
	Consortiums and organisations										
	Working Group Committees										
	Standards focused on Wood and Furniture Sector										
	How to apply standards to factories interested in Industry 4.0										
	Legal issues in Industry 4.0										

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Title of the Unit:	Digital and Physic World Hybridising	
Sub Units	**Sections**	
3d Printing and Additive Manufacturing for Furniture Manufacturing.	Introduction to 3D printing and Additive Manufacturing	What is 3D printing?
		A brief description of 3D printing.
		Main materials for 3D printing
		Workflow: How 3d printing works?
		Production process in 3D printing
		A brief description of the main software used in 3D printing
Augmented Reality and Intelligent Tools that may be Used During the Design and Fabrication of the Product.	Introduction to Augmented Reality	What is Augmented Reality?
		Differences between AR and Virtual Reality
		Workflow: How AR works?
		A Brief Description of some software used in AR
Examples of Performance Activities Developed in BLM department or Dissemination.	Example 1	
	Example 2	
	Example 3	
	…	
	Example n	
Sensors and Wearables	Introduction	Definition
		Context in the Industry/Companies
	Business Success stories	
	Future of Sensors and Wearables in Industry	
Robotics applied to furniture production at the different production stages	Introduction	Design principles for I4.0
		Introduction to Cyber Physical Systems
	Use cases	Examples and case studies
		Applications in furniture manufactures
Simulation, modelling and virtualization in the design, virtual catalogues, 3D scanning.	Introduction	Main objectives and focus of virtualization in the furniture/interiors sector
		Why? Enhancement of market competitiveness thanks to the correct use of tools
	Main Concepts	Approach to simulation, modelling, render and virtualization
		Panorama of existing tools, technologies and software
		How to select the most appropriate tool for specific purposes
	Examples and good practices	Case studies: focus on furniture/interiors SMEs
	Practical exercises: 3DS MAX	Preview and introduction (general notions about display windows, views, use of standard navigation methods, selection methods, grouping, setting up unit of measurement...)
		Transformation commands
		Creation of primitive and composite objects
		Edit Commands and modifiers
		Importing files with other extensions
	Practical exercises: CORONA RENDERER	Main Features of the Corona Renderer module (introduction to the Photography and light behavior in reality and within the render engine, set up of Corona as default rendering engine of 3ds Max)
		Materials, "Material Editor". Set a standard material (Corona Mtl), how to apply the texture on the material (UV and Tiling)
		Settings, "Render Setup" windows. Workflow optimization
		Set reflections and refractions, adjust the distribution of light on the surface through Glossiness, Bump effect and its uses
		Concepts of lighting technology (creation and alteration of lights (Corona light), uses and Color temperature properties, creation of photographic setups for "Still Life" of objects of design (with Limbo Fotografico), import of files containing lighting information IES
		Camera placement (creation and editing of Standard Camera or Corona Camera, add camera's effects such as field blur (DOF) in post- production

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Title of the Unit:	Telecommunications and data

Sub Units	Sections	
Internet of Things	Introduction to I.o.T	What is IoT?
		Related Concepts
		How does IoT work?
		Application of IoT
		Commercial Aspects
		Concerns (privacy, security, health, etc.)
	Features of IoT	Architecture
		Intelligence
		Automation
		Design
	Technologies of IoT	The Cloud
		Wired and wireless networks
		Cyber-physical systems
		Technological Standards
	Technologies related to IoT	Computational Semantics
		Rule Engines
		Big data and Analytics
	IoT framework: SOFIA2	The SOFIA2 environment
		Defining your architecture
		The SOFIA2 Console
		Connecting to the SIB
		Creating your own KP
		The information producer
		Rule definition
	Can you build your own IoT environment?	Test 1: Set up the server
		Test 2: Build the clients
		Test 3: Connectivity
		Test 4: Intelligence
		Conclusions
Integrated Systems	Theoretical aspects	Complexity theory
		Networks in complex systems
		Legacy and path dependency
		Convergence and divergence
		Synergy, adaptation and evolution
	Architecture	The service economy
		Service-oriented architecture
		Event-oriented architecture
		Modularity and self-organization
		System ecology
	Implementation	Middleware for distributed applications
		Integration topologies
		Integration challenges
Big Data & Analytics	Big data theory	Big data fundaments
		Big data platform
		Big data methodology
		Use cases and added value
	Big data technologies	Big data technologies I
		Big data technologies II
	Using big data	Data access
		Administration and data structures
		Advanced programming
	Analytics	Analytics fundaments
		Patterns, relationships and predictive modeling
		Data manipulation and machine learning
		Analytics technologies

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Title of the Unit:	Telecommunications and data

Sub Units	Sections	
Cloud Computing	Introduction	Definition
		Context in the Industry/Companies
	Advantages and disadvantages of Cloud Computing	
	Business success stories	
	Future of Cloud Computing in Industry	
Communication Networks	Introduction	Definition
		Context in the Industry/Companies
	Business Success Stories	
	Future of Communication Networks in Industry.	
Cyber-Security	Introduction	Definition
		Context in the Industry/Companies
	Business Success Stories	
	Future of Cyber-Security	

Title of the Unit:	Management Systems

Sub Units	Sections	
Applications of Logistics	Warehouse management systems	Introduction
		Warehouse Activities
		Factors that influence the effective use of warehouses
		Types of Warehouse
		Design and Distribution in Plant
		Definition and Characteristics SGA
		Relationship of the SGA with the Value Chain
		Recommendations SGA Implementation
	Inventory management and DRP (Distribution Resource Planning)	Introduction
		Types of Inventories
		Types of Demands
		Inventory Cost
		FIFO and LIFO
		ABC Classification
		DRP Definition
		DRP Relationship with the Value Chain
		DRP Techniques
		DRP Safety Inventory
	Table of Board of KPIs (Key Performance Indicators)	Introduction
		KPI Types
		Characteristics, how they must be
		KPI Incidence in Continuous Improvement
		Implementation and Follow-up Industry Furniture
	Data capture systems for plant processes control (RFID: Radio Frequency Identification…)	Definitions
		Types of RFID
		How does it work?
		Uses and Implementation Industry Furniture
Workflow Management Systems	APP (Aggregate Production Planning) and Capacity control and Capacity Requirement Planning MPS (Master Production Schedule) and MRP II	Strategic Planning
		Production Planning
		PAP Production Aggregate Plan: Definition, Characteristics and Application Example Industry Furniture
		Capacity Requirement Planning: Definition, Characteristics and Application Example Industry Furniture
		Tactical Planning

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Title of the Unit:	Management Systems

Sub Units	Sections	
	(Manufacturing Resource Planning)	Master Production Plan: Definition, Characteristics and Example of Application
		Material Requirement Plan: Definition, Characteristics and Example of Application
	ERP (Enterprise Resource Planning)	Definition and Characteristics
		Types of ERP
		Uses and Implementation Industry Furniture
	Lean Manufacturing (workflow and improvement of manufacturing operations)	Introduction
		Basic Lean Tools
		Advanced Lean Tools
		Examples Application Industry Furniture
Collaborative Platforms	U2B (University to Business)	Recommendation of possible Platforms along with aggregation recommendations to include data from current partners' approaches
	U2S (University to Student) S2S (Student to Student)	Identification of partners current mechanisms for U2S and to enable S2S communication.
		Research into best practice and most successful cost-effective options for U2S and S2S communication.
		Recommendation of possible Platforms along with aggregation recommendations to include data from current partners' approaches

Title of the Unit:	Standards, certifications and legal issues

Sub Units	Sections
Introduction to standardization	Definition
	Context in the industry/companies
	Why is standardization is an important issue?
State of art/challenges in standardization in I4.0	
Consortiums and organisations	Summary of consortiums and organisations
Working Group Committees	Automation Systems and Integration
	Robots and Robotic devices
Standards focused on Wood and Furniture Sector	
How to apply standards to factories interested in Industry 4.0	

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Title of the Unit:	Digital and Physic World Hybridising

Sub Units	Sections	
3d Printing and Additive Manufacturing for Furniture Manufacturing.	Introduction to 3D printing and Additive Manufacturing	What is 3D printing?
		A brief description of 3D printing.
		Main materials for 3D printing
		Workflow: How 3d printing works?
		Production process in 3D printing
		A brief description of the main software used in 3D printing
	Application of 3D printing in the Furniture sector	Design and Prototyping
		Molds for Prototyping and final products
		Final products. Batches if size 1 up to X
Augmented Reality and Intelligent Tools that may be Used During the Design and Fabrication of the Product.	Introduction to Augmented Reality	What is Augmented Reality?
		Differences between AR and Virtual Reality
		Workflow: How AR works?
		A Brief Description of some software used in AR
	Application of the Augmented Reality during the design and fabrication stage of the product.	Design and prototyping
		Production process
		Picking
		Maintenance
		Training for Workers
Examples of Performance Activities Developed in BLM department or Dissemination.	Example 1	
	Example 2	
	Example 3	
	…	
	Example n	
Sensors and Wearables	Introduction	Definition
		Context in the Industry/Companies
	Business Success stories	
	Future of Sensors and Wearables in Industry	
Robotics applied to furniture production at the different production stages	Introduction	Design principles for I4.0
		Introduction to Cyber Physical Systems
	Definitions and Concepts	From Industrial robotics to collaborative robotics
		Robotics and Artificial Intelligence
		Embedded systems
		Internet of Intelligent Robotics Things
		Cloud Robotics
	Use cases	Examples and case studies
		Applications in furniture manufactures
		Business models
	Practical exercises	Robotic Operating System (ROS)
		Cloud platforms (Azure, Amazon, …??)
Simulation, modelling and virtualization in the design, virtual catalogues, 3D scanning.	Introduction	Main objectives and focus of virtualization in the furniture/interiors sector
		Why? Enhancement of market competitiveness thanks to the correct use of tools
	Main Concepts	Approach to simulation, modelling, render and virtualization
		Panorama of existing tools, technologies and software
		How to select the most appropriate tool for specific purposes
	Examples and good practices	Case studies: focus on furniture/interiors SMEs
	Practical exercises: 3DS MAX	Preview and introduction (general notions about display windows, views, use of standard navigation methods, selection methods, grouping, setting up unit of measurement...)
		Transformation commands
		Creation of primitive and composite objects
		Edit Commands and modifiers
		Importing files with other extensions

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Title of the Unit:	Digital and Physic World Hybridising

Sub Units	Sections	
	Practical exercises: CORONA RENDERER	Main Features of the Corona Renderer module (introduction to the Photography and light behavior in reality and within the render engine, set up of Corona as default rendering engine of 3ds Max)
		Materials, "Material Editor". Set a standard material (Corona Mtl), how to apply the texture on the material (UV and Tiling)
		Settings, "Render Setup" windows. Workflow optimization
		Set reflections and refractions, adjust the distribution of light on the surface through Glossiness, Bump effect and its uses
		Concepts of lighting technology (creation and alteration of lights (Corona light), uses and Color temperature properties, creation of photographic setups for "Still Life" of objects of design (with Limbo Fotografico), import of files containing lighting information IES
		Camera placement (creation and editing of Standard Camera or Corona Camera, add camera's effects such as field blur (DOF) in post- production

Title of the Unit:	Telecommunications and data

Sub Units	Sections	
Internet of Things	Introduction to I.o. T	What is IoT?
		Related Concepts
		How does IoT work?
		Application of IoT
		Commercial Aspects
		Concerns (privacy, security, health, etc.)
	Features of IoT	Architecture
		Intelligence
		Automation
		Design
	Technologies of IoT	The Cloud
		Wired and wireless networks
		Cyber-physical systems
		Technological Standards
	Technologies related to IoT	Computational Semantics
		Rule Engines
		Big data and Analytics
	IoT framework: SOFIA2	The SOFIA2 environment
		Defining your architecture
		The SOFIA2 Console
		Connecting to the SIB
		Creating your own KP
		The information producer
		Rule definition
	Can you build your own IoT environment?	Test 1: Set up the server
		Test 2: Build the clients
		Test 3: Connectivity
		Test 4: Intelligence
		Conclusions
Integrated Systems	Theoretical aspects	Complexity theory
		Networks in complex systems
		Legacy and path dependency
		Convergence and divergence
		Synergy, adaptation and evolution
	Architecture	The service economy
		Service-oriented architecture

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Title of the Unit:	Telecommunications and data

Sub Units	Sections	
		Event-oriented architecture
		Modularity and self-organization
		System ecology
	Implementation	Middleware for distributed applications
		Integration topologies
		Integration challenges
Big Data & Analytics	Big data theory	Big data fundaments
		Big data platform
		Big data methodology
		Use cases and added value
	Big data technologies	Big data technologies I
		Big data technologies II
	Using big data	Data access
		Administration and data structures
		Advanced programming
	Analytics	Analytics fundaments
		Patterns, relationships and predictive modeling
		Data manipulation and machine learning
		Analytics technologies
Cloud Computing	Introduction	Definition
		Context in the Industry/Companies
		Advantages and disadvantages of Cloud Computing
		Business success stories
		Future of Cloud Computing in Industry
Communication Networks	Introduction	Definition
		Context in the Industry/Companies
		Business Success Stories
		Future of Communication Networks in Industry.
Cyber-Security	Introduction	Definition
		Context in the Industry/Companies
		Business Success Stories
		Future of Cyber-Security

Title of the Unit:	Management Systems

Sub Units	Sections	
Applications of Logistics	Warehouse management systems	Introduction
		Warehouse Activities
		Factors that influence the effective use of warehouses
		Types of Warehouse
		Design and Distribution in Plant
		Definition and Characteristics SGA
		Relationship of the SGA with the Value Chain
		Recommendations SGA Implementation
	Inventory management and DRP (Distribution Resource Planning)	Introduction
		Types of Inventories
		Types of Demands
		Inventory Cost
		FIFO and LIFO
		ABC Classification
		DRP Definition
		DRP Relationship with the Value Chain
		DRP Techniques

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Title of the Unit:	Management Systems

Sub Units	Sections	
		DRP Safety Inventory
	Table of Board of KPIs (Key Performance Indicators)	Introduction
		KPI Types
		Characteristics, how must be
		KPI Incidence in Continuous Improvement
		Implementation and Follow-up Industry Furniture
	Data capture systems for plant processes control (RFID: Radio Frequency Identification…)	Definitions
		Types of RFID
		How does it work?
		Uses and Implementation Industry Furniture
Workflow Management Systems	APP (Aggregate Production Planning) and Capacity control and Capacity Requirement Planning MPS (Master Production Schedule) and MRP II (Manufacturing Resource Planning)	Strategic Planning
		Production Planning
		PAP Production Aggregate Plan: Definition, Characteristics and Application Example Industry Furniture
		Capacity Requirement Planning: Definition, Characteristics and Application Example Industry Furniture
		Tactical Planning
		Master Production Plan: Definition, Characteristics and Example of Application
		Material Requirement Plan: Definition, Characteristics and Example of Application
	ERP (Enterprise Resource Planning)	Definition and Characteristics
		Types of ERP
		Uses and Implementation Industry Furniture
	Lean Manufacturing (workflow and improvement of manufacturing operations)	Introduction
		Basic Lean Tools
		Advanced Lean Tools
		Examples Application Industry Furniture
Collaborative Platforms	U2B (University to Business)	Research into best practice and most successful cost-effective options for U2B communication.
		Recommendation of possible Platforms along with aggregation recommendations to include data from current partners' approaches
	U2S (University to Student) S2S (Student to Student)	Identification of partners current mechanisms for U2S and to enable S2S communication.
		Research into best practice and most successful cost-effective options for U2S and S2S communication.
		Recommendation of possible Platforms along with aggregation recommendations to include data from current partners' approaches

Title of the Unit:	Standards, certifications and legal issues

Sub Units	Sections
Introduction to standardization	Definition
	Context in the industry/companies
	Why is standardization is an important issue?
State of art/challenges in standardization in I4.0	
Consortiums and organisations	Summary of consortiums and organisations
Working Group Committees	Automation Systems and Integration
	Robots and Robotic devices
Standards focused on Wood and Furniture Sector	

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Title of the Unit:	Standards, certifications and legal issues

Sub Units	Sections
How to apply standards to factories interested in Industry 4.0	

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Title of the Unit:	Digital and Physic World Hybridising

Sub Units	Sections	
3d Printing and Additive Manufacturing for Furniture Manufacturing.	Introduction to 3D printing and Additive Manufacturing	What is 3D printing?
		A brief description of 3D printing.
		Main materials for 3D printing
		Workflow: How 3d printing works?
		Production process in 3D printing
	Commercial Aspects	
Augmented Reality and Intelligent Tools that may be Used During the Design and Fabrication of the Product.	Introduction to Augmented Reality	What is Augmented Reality?
		Differences between AR and Virtual Reality
		Workflow: How AR works?
	Augmented Reality in the Commercial Market	
Sensors and Wearables	Introduction	Definition
		Context in the Industry/Companies
	Main Characteristics	
	Types	Summary of types of sensors and wearables
	Use Cases	
	Business Success stories	
	Future of Sensors and Wearables in Industry	
Robotics applied to furniture production at the different production stages	Introduction	Design principles for I4.0
		Introduction to Cyber Physical Systems
	Use cases	Examples and case studies
		Applications in furniture manufactures
		Business models
Simulation, modelling and virtualization in the design, virtual catalogues, 3D scanning.	Introduction	Main objectives and focus of virtualization in the furniture/interiors sector
		Why? Enhancement of market competitiveness thanks to the correct use of tools
	Main Concepts	Approach to simulation, modelling, render and virtualization
		Panorama of existing tools, technologies and software
		How to select the most appropriate tool for specific purposes
	Examples and good practices	Case studies: focus on furniture/interiors SMEs

Title of the Unit:	Telecommunications and data

Sub Units	Sections	
Internet of Things	Introduction to I.o.T	What is IoT?
		Related Concepts
		How does IoT work?
		Application of IoT
		Commercial Aspects
		Concerns (privacy, security, health, etc.)
	Features of IoT (Opt)	Architecture
		Intelligence
		Automation
		Design
	Technologies of IoT	The Cloud
		Wired and wireless networks
		Cyber-physical systems
		Technological Standards
	Technologies related to IoT	Computational Semantics
		Rule Engines
		Big data and Analytics

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Title of the Unit:	Telecommunications and data

Sub Units	Sections	
Integrated Systems	Theoretical aspects	Complexity theory
		Networks in complex systems
		Legacy and path dependency
		Convergence and divergence
		Synergy, adaptation and evolution
	Architecture	The service economy
		Service-oriented architecture
		Event-oriented architecture
		Modularity and self-organization
		System ecology
Big Data & Analytics	Big data theory	Big data fundaments
		Use cases and added value
	Big data technologies	Big data technologies I
		Big data technologies II
	Analytics	Patterns, relationships and predictive modeling
		Data manipulation and machine learning
		Analytics technologies
Cloud Computing	Introduction	Definition
		Context in the Industry/Companies
		Main Characteristics
	Models of Cloud Computing	Summary of CC models
	Deployment Models	Summary of deployment models
		Advantages and disadvantages of Cloud Computing
		Business success stories
		Future of Cloud Computing in Industry
Communication Networks	Introduction	Definition
		Context in the Industry/Companies
	Industrial Communication networks (description and examples)	Summary of Industrial communication networks
	Industrial Communication standards	Summary of Industrial communication standards
		Use Cases
		Business Success Stories
		Future of Communication Networks in Industry.
Cyber-Security	Introduction	Definition
		Context in the Industry/Companies
	Types	Summary of cyber-security strategies
	Evaluation	Pentesting (Penetration testing
		Use Cases
		Business Success Stories
		Future of Cyber-Security

Title of the Unit:	Management Systems

Sub Units	Sections	
	Table of Board of KPIs (Key Performance Indicators)	Introduction
		KPI Types
		Characteristics, how they must be
		KPI Incidence in Continuous Improvement
		Implementation and Follow-up Industry Furniture

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Title of the Unit:	Management Systems

Sub Units	Sections	
Workflow Management Systems	APP (Aggregate Production Planning) and Capacity control and Capacity Requirement Planning	Strategic Planning
	ERP (Enterprise Resource Planning)	Definition and Characteristics
		Types of ERP
		Uses and Implementation Industry Furniture
	Lean Manufacturing (workflow and improvement of manufacturing operations)	Introduction
		Basic Lean Tools
		Advanced Lean Tools
		Examples Application Industry Furniture
Collaborative platforms	B2B (Business to Business) B2C (Business to Consumer) C2C (Consumer to Consumer)	Identification of partners current mechanisms for B2B, B2C and to enable C2C communication.
		Research into best practice and most successful cost-effective options for B2B, B2C and C2C communication.
		Recommendation of possible Platforms along with aggregation recommendations to include data from current partners' approaches
	U2B (University to Business)	Identification of partners current mechanisms for U2B communication.
		Research into best practice and most successful cost-effective options for U2B communication.
		Recommendation of possible Platforms along with aggregation recommendations to include data from current partners' approaches

Title of the Unit:	Standards, certifications and legal issues

Sub Units	Sections
Introduction to standardization	Definition
	Context in the industry/companies
	Why is standardization is an important issue?
State of art/challenges in standardization in I4.0	
Consortia and Organisations	Summary of consortiums and organisations
Working Group Committees	Summary of working group committees
Standards focused on Wood and Furniture Sector	
How to apply standards to factories interested in Industry 4.0	
Legal issues in Industry 4.0	

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Title of the Unit:	Digital and Physic World Hybridising

Sub Units	Sections	
3d Printing and Additive Manufacturing for Furniture Manufacturing.	Introduction to 3D printing and Additive Manufacturing	What is 3D printing?
		A brief description of 3D printing.
		Main materials for 3D printing
		Workflow: How 3d printing works?
		Production process in 3D printing
	Application of 3D printing in the Furniture sector	Design and Prototyping
		Molds for Prototyping and final products
		Final products. Batches if size 1 up to X
	Commercial Aspects	
Augmented Reality and Intelligent Tools that may be Used During the Design and Fabrication of the Product.	Introduction to Augmented Reality	What is Augmented Reality?
		Differences between AR and Virtual Reality
		Workflow: How AR works?
	Application of the Augmented Reality during the design and fabrication stage of the product.	Design and prototyping
		Production process
		Picking
		Maintenance
		Training for Workers
	Augmented Reality in the Commercial Market	
Sensors and Wearables	Introduction	Definition
		Context in the Industry/Companies
	Main Characteristics	
	Types	Summary of types of sensors and wearables
	Use Cases	
	Business Success stories	
	Future of Sensors and Wearables in Industry	
Robotics applied to furniture production at the different production stages	Introduction	Design principles for I4.0
		Introduction to Cyber Physical Systems
	Use cases	Examples and case studies
		Applications in furniture manufactures
		Business models
Simulation, modelling and virtualization in the design, virtual catalogues, 3D scanning.	Introduction	Main objectives and focus of virtualization in the furniture/interiors sector
		Why? Enhancement of market competitiveness thanks to the correct use of tools
	Main Concepts	Approach to simulation, modelling, render and virtualization
		Panorama of existing tools, technologies and software
		How to select the most appropriate tool for specific purposes
	Examples and good practices	Case studies: focus on furniture/interiors SMEs
	Practical exercises: 3DS MAX	Preview and introduction (general notions about display windows, views, use of standard navigation methods, selection methods, grouping, setting up unit of measurement...)
		Transformation commands
		Creation of primitive and composite objects
		Edit Commands and modifiers
		Importing files with other extensions

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Title of the Unit:	Digital and Physic World Hybridising	
Sub Units	**Sections**	
	Practical exercises: CORONA RENDERER	Main Features of the Corona Renderer module (introduction to the Photography and light behavior in reality and within the render engine, set up of Corona as default rendering engine of 3ds Max)
		Materials, "Material Editor". Set a standard material (Corona Mtl), how to apply the texture on the material (UV and Tiling)
		Settings, "Render Setup" windows. Workflow optimization
		Set reflections and refractions, adjust the distribution of light on the surface through Glossiness, Bump effect and its uses
		Concepts of lighting technology (creation and alteration of lights (Corona light), uses and Color temperature properties, creation of photographic setups for "Still Life" of objects of design (with Limbo Fotografico), import of files containing lighting information IES
		Camera placement (creation and editing of Standard Camera or Corona Camera, add camera's effects such as field blur (DOF) in post- production

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Title of the Unit:	Telecommunications and data	
Sub Units	**Sections**	
Internet of Things	Introduction to I.o.T	What is IoT?
		Related Concepts
		How does IoT work?
		Application of IoT
		Commercial Aspects
		Concerns (privacy, security, health, etc.)
	Features of IoT	Architecture
		Intelligence
		Automation
		Design
	Technologies related to IoT	Computational Semantics
		Rule Engines
		Big data and Analytics
	IoT framework: SOFIA2 (opt.)	The SOFIA2 environment
		Defining your architecture
		The SOFIA2 Console
		Connecting to the SIB
		Creating your own KP
		The information producer
		Rule definition
	Can you build your own IoT environment? (opt.)	Test 1: Set up the server
		Test 2: Build the clients
		Test 3: Connectivity
		Test 4: Intelligence
		Conclusions
Integrated Systems	Theoretical aspects	Complexity theory
		Networks in complex systems
		Legacy and path dependency
		Convergence and divergence
		Synergy, adaptation and evolution
	Architecture	The service economy
		Service-oriented architecture
		Event-oriented architecture
		Modularity and self-organization
		System ecology
	Implementation	Middleware for distributed applications
		Integration topologies
		Integration challenges
Big Data & Analytics	Big data theory	Big data fundaments
		Big data platform
		Big data methodology
		Use cases and added value
	Big data technologies	Big data technologies I
		Big data technologies II
	Using big data	Data access
		Administration and data structures
		Advanced programming
	Analytics	Analytics fundaments
		Patterns, relationships and predictive modeling
		Data manipulation and machine learning
		Analytics technologies
Cloud Computing	Introduction	Definition
		Context in the Industry/Companies
		Main Characteristics

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Title of the Unit:	Telecommunications and data

Sub Units	Sections	
	Models of Cloud Computing	Summary of CC models
	Deployment Models	Summary of deployment models
		Advantages and disadvantages of Cloud Computing
		Business success stories
		Future of Cloud Computing in Industry
Communication Networks	Introduction	Definition
		Context in the Industry/Companies
	Industrial Communication Networks (description and examples).	Summary of Industrial communication networks
	Industrial Communication Standards	OPC UA
		Power Link
		Open Safety
		TCP/IP
		Summary of Industrial communication standards
		Use Cases
		Business Success Stories
		Future of Communication Networks in Industry.
Cyber-Security	Introduction	Definition
		Context in the Industry/Companies
	Types	Summary of cyber-security strategies
	Evaluation	Pentesting (Penetration testing
		Use Cases
		Business Success Stories
		Future of Cyber-Security

Title of the Unit:	Management Systems

Sub Units	Sections	
Applications of Logistics	Warehouse management systems	Introduction
		Warehouse Activities
		Factors that influence the effective use of warehouses
		Types of Warehouse
		Design and Distribution in Plant
		Definition and Characteristics SGA
		Relationship of the SGA with the Value Chain
		Recommendations SGA Implementation
	Inventory management and DRP (Distribution Resource Planning)	Introduction
		Types of Inventories
		Types of Demands
		Inventory Cost
		FIFO and LIFO
		ABC Classification
		DRP Definition
		DRP Relationship with the Value Chain
		DRP Techniques
		DRP Safety Inventory
	Table of Board of KPIs (Key Performance Indicators)	Introduction
		KPI Types
		Characteristics, How must be
		KPI Incidence in Continuous Improvement

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Title of the Unit:	Management Systems	
Sub Units	**Sections**	
		Implementation and Follow-up Industry Furniture
	Data capture systems for plant processes control (RFID: Radio Frequency Identification…)	Definitions
		Types of RFID
		How does it work?
		Uses and Implementation Industry Furniture
Workflow Management Systems	APP (Aggregate Production Planning) and Capacity control and Capacity Requirement Planning MPS (Master Production Schedule) and MRP II (Manufacturing Resource Planning)	Strategic Planning
		Production Planning
		PAP Production Aggregate Plan: Definition, Characteristics and Application Example Industry Furniture
		Capacity Requirement Planning: Definition, Characteristics and Application Example Industry Furniture
		Tactical Planning
		Master Production Plan: Definition, Characteristics and Example of Application
		Material Requirement Plan: Definition, Characteristics and Example of Application
	ERP (Enterprise Resource Planning)	Definition and Characteristics
		Types of ERP
		Uses and Implementation Industry Furniture
	Lean Manufacturing (workflow and improvement of manufacturing operations)	Introduction
		Basic Lean Tools
		Advanced Lean Tools
		Examples Application Industry Furniture
Collaborative platforms	B2B (Business to Business) B2C (Business to Consumer) C2C (Consumer to Consumer)	Identification of partners current mechanisms for B2B, B2C and to enable C2C communication.
		Research into best practice and most successful cost-effective options for B2B, B2C and C2C communication.
		Recommendation of possible Platforms along with aggregation recommendations to include data from current partners' approaches
	U2B (University to Business)	Identification of partners current mechanisms for U2B communication.
		Research into best practice and most successful cost-effective options for U2B communication.
		Recommendation of possible Platforms along with aggregation recommendations to include data from current partners' approaches

Title of the Unit:	Standards, certifications and legal issues
Sub Units	**Sections**
Introduction to standardization	Definition
	Context in the industry/companies
	Why is standardization is an important issue?
State of art/challenges in standardization in I4.0	
Consortia and Organisations	Summary of consortiums and organisations
Working Group Committees	Summary of working group committees
Standards focused on Wood and Furniture Sector	
How to apply standards to factories interested in Industry 4.0	
Legal issues in Industry 4.0	

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Title of the Unit:	Digital and Physic World Hybridising

Sub Units	Sections	
3d Printing and Additive Manufacturing for Furniture Manufacturing.	Introduction to 3D printing and Additive Manufacturing	What is 3D printing?
		A brief description of 3D printing.
		Main materials for 3D printing
		Workflow: How 3d printing works?
		Production process in 3D printing
		A brief description of the main software used in 3D printing
Augmented Reality and Intelligent Tools that may be Used During the Design and Fabrication of the Product.	Introduction to Augmented Reality	What is Augmented Reality?
		Differences between AR and Virtual Reality
		Workflow: How AR works?
		A Brief Description of some software used in AR
Examples of Performance Activities Developed in BLM department or Dissemination.	Example 1	
	Example 2	
	Example 3	
	…	
	Example n	
Sensors and Wearables	Introduction	Definition
		Context in the Industry/Companies
	Main Characteristics	
	Types	Smart Sensors
		SCADA
		Wireless Sensors & Networks
		MEMS/Nano sensors
		Energy Harvesting
	Use Cases	
	Business Success stories	
	Future of Sensors and Wearables in Industry	
Robotics applied to furniture production at the different production stages	Introduction	Design principles for I4.0
		Introduction to Cyber Physical Systems
	Definitions and Concepts	From Industrial robotics to collaborative robotics
		Robotics and Artificial Intelligence
		Embedded systems
		Internet of Intelligent Robotics Things
		Cloud Robotics
	Use cases	Examples and case studies
		Applications in furniture manufactures
	Practical exercises	Robotic Operating System (ROS)
		Cloud platforms (Azure, Amazon, …??)
Simulation, modelling and virtualization in the design, virtual catalogues, 3D scanning.	Introduction	Main objectives and focus of virtualization in the furniture/interiors sector
		Why? Enhancement of market competitiveness thanks to the correct use of tools
	Main Concepts	Approach to simulation, modelling, render and virtualization
		Panorama of existing tools, technologies and software
		How to select the most appropriate tool for specific purposes
	Examples and good practices	Case studies: focus on furniture/interiors SMEs
	Practical exercises: 3DS MAX	Preview and introduction (general notions about display windows, views, use of standard navigation methods, selection methods, grouping, setting up unit of measurement…)
		Transformation commands
		Creation of primitive and composite objects
		Edit Commands and modifiers
		Importing files with other extensions
	Practical exercises: CORONA RENDERER	Main Features of the Corona Renderer module (introduction to the Photography and light behavior in reality and within the render engine, set up of Corona as default rendering engine of 3ds Max)

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Title of the Unit:	Digital and Physic World Hybridising

Sub Units	Sections	
		Materials, "Material Editor". Set a standard material (Corona Mtl), how to apply the texture on the material (UV and Tiling)
		Settings, "Render Setup" windows. Workflow optimization
		Set reflections and refractions, adjust the distribution of light on the surface through Glossiness, Bump effect and its uses
		Concepts of lighting technology (creation and alteration of lights (Corona light), uses and Color temperature properties, creation of photographic setups for "Still Life" of objects of design (with Limbo Fotografico), import of files containing lighting information IES
		Camera placement (creation and editing of Standard Camera or Corona Camera, add camera's effects such as field blur (DOF) in post- production

Title of the Unit:	Telecommunications and data

Sub Units	Sections	
Internet of Things	Introduction to I.o.T	What is IoT?
		Related Concepts
		How does IoT work?
		Application of IoT
		Commercial Aspects
		Concerns (privacy, security, health, etc.)
	Features of IoT	Architecture
		Intelligence
		Automation
		Design
	Technologies of IoT	The Cloud
		Wired and wireless networks
		Cyber-physical systems
		Technological Standards
	Technologies related to IoT	Computational Semantics
		Rule Engines
		Big data and Analytics
	IoT framework: SOFIA2	The SOFIA2 environment
		Defining your architecture
		The SOFIA2 Console
		Connecting to the SIB
		Creating your own KP
		The information producer
		Rule definition
	Can you build your own IoT environment?	Test 1: Set up the server
		Test 2: Build the clients
		Test 3: Connectivity
		Test 4: Intelligence
		Conclusions
Integrated Systems	Theoretical aspects	Complexity theory
		Networks in complex systems
		Legacy and path dependency
		Convergence and divergence
		Synergy, adaptation and evolution
	Architecture	The service economy
		Service-oriented architecture
		Event-oriented architecture
		Modularity and self-organization
		System ecology

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Title of the Unit:	Telecommunications and data

Sub Units	Sections	
	Implementation	Middleware for distributed applications
		Integration topologies
		Integration challenges
Big Data & Analytics	Big data theory	Big data fundaments
		Big data platform
		Big data methodology
		Use cases and added value
	Big data technologies	Big data technologies I
		Big data technologies II
	Using big data	Data access
		Administration and data structures
		Advanced programming
	Analytics	Analytics fundaments
		Patterns, relationships and predictive modeling
		Data manipulation and machine learning
		Analytics technologies
Cloud Computing	Introduction	Definition
		Context in the Industry/Companies
		Main Characteristics
	Models of Cloud Computing	Infrastrucure as a Service (IaaS)
		Platform as a Service (PaaS)
		Software as a Service (SaaS)
		Emerging models
	Deployment models	Public
		Private
		Hybrid
		Community
		Advantages and disadvantages of Cloud Computing
		Business success stories
		Future of Cloud Computing in Industry
Communication Networks	Introduction	Definition
		Context in the Industry/Companies
	Industrial Communication networks (description and examples)	Body Area Networks (BAN): NFC, Bluetooth Low Energy, Bluetooth 4.0
		Personal Area Networks (PAN): Bluetooth, Zigbee.
		Local Area Networks (LAN): Ethernet, Industrial Ethernet, Rofbus, Profinet, M-Bus
		Wide Area Networks (WAN): GPRS, UMTS, LTE.
	Industrial Communication Standards	OPC UA
		Power Link
		Open Safety
		TCP/IP
		Use Cases
		Business Success Stories
		Future of Communication Networks in Industry.
Cyber-Security	Introduction	Definition
		Context in the Industry/Companies
	Types	User & Password
		Fingerprint
		Face Recognition
		Cryptography
		Federation
	Evaluation	Pentesting (Penetration testing
		Use Cases
		Business Success Stories
		Future of Cyber-Security

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Title of the Unit:	Management Systems

Sub Units	Sections	
Application of Logistics	Table of Board of KPIs (Key Performance Indicators)	Introduction
		KPI Types
		Characteristics, how they must be
		KPI Incidence in Continuous Improvement
		Implementation and Follow-up Industry Furniture
	Data capture systems for plant processes control (RFID: Radio Frequency Identification…)	Definitions
		Types of RFID
		How does it work?
		Uses and Implementation Industry Furniture
Workflow management Systems	ERP (Enterprise Resource Planning)	Definition and Characteristics
		Types of ERP
		Uses and Implementation Industry Furniture
	Lean Manufacturing (workflow and improvement of manufacturing operations)	Introduction
		Basic Lean Tools
Collaborative Platforms	U2S (University to Student) S2S (Student to Student)	Identification of partners current mechanisms for U2S and to enable S2S communication.
		Research into best practice and most successful cost-effective options for U2S and S2S communication.
		Recommendation of possible Platforms along with aggregation recommendations to include data from current partners' approaches

Title of the Unit:	Standards, certifications and legal issues

Sub Units	Sections
Introduction to standardization	Definition
	Context in the industry/companies
	Why is standardization is an important issue?
State of art/challenges in standardization in I4.0	
Consortiums and organisations	IEC/ISO
	IETF/W3C
	DKE/DIN
	ETSI/CENELEC/CEN
Working Group Committees	CyberSecurity, industrial networks
	Automation Systems and Integration
	Robots and Robotic devices
	Sensor Networks
	Internet of Things
	Big Data
	Cloud Computing and Distributed Platforms
How to apply standards to factories interested in Industry 4.0	

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Title of the Unit:	Digital and Physic World Hybridising	
Sub Units	**Sections**	
3d Printing and Additive Manufacturing for Furniture Manufacturing.	Introduction to 3D printing and Additive Manufacturing	What is 3D printing?
		A brief description of 3D printing.
		Main materials for 3D printing
		Workflow: How 3d printing works?
		Production process in 3D printing
		A brief description of the main software used in 3D printing
	Application of 3D printing in the Furniture sector	Design and Prototyping
		Molds for Prototyping and final products
		Final products. Batches if size 1 up to X
Augmented Reality and Intelligent Tools that may be Used During the Design and Fabrication of the Product.	Introduction to Augmented Reality	What is Augmented Reality?
		Differences between AR and Virtual Reality
		Workflow: How AR works?
		A Brief Description of some software used in AR
	Application of the Augmented Reality during the design and fabrication stage of the product.	Design and prototyping
		Production process
		Picking
		Maintenance
		Training for Workers
Examples of Performance Activities Developed in BLM department or Dissemination.	Example 1	
	Example 2	
	Example 3	
	…	
	Example n	
Sensors and Wearables	Introduction	Definition
		Context in the Industry/Companies
	Main Characteristics	
	Types	Smart Sensors
		SCADA
		Wireless Sensors & Networks
		MEMS/Nano sensors
		Energy Harvesting
	Use Cases	
	Business Success stories	
	Future of Sensors and Wearables in Industry	
Robotics applied to furniture production at the different production stages	Introduction	Design principles for I4.0
		Introduction to Cyber Physical Systems
	Definitions and Concepts	From Industrial robotics to collaborative robotics
		Robotics and Artificial Intelligence
		Embedded systems
		Internet of Intelligent Robotics Things
		Cloud Robotics
	Use cases	Examples and case studies
		Applications in furniture manufactures
	Practical exercises	Robotic Operating System (ROS)
		Cloud platforms (Azure, Amazon, …??)
Simulation, modelling and	Introduction	Main objectives and focus of virtualization in the furniture/interiors sector
		Why? Enhancement of market competitiveness thanks to the correct use of tools

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Title of the Unit:	Digital and Physic World Hybridising

Sub Units	Sections	
virtualization in the design, virtual catalogues, 3D scanning.	Main Concepts	Approach to simulation, modelling, render and virtualization
		How to select the most appropriate tool for specific purposes
	Examples and good practices	Case studies: focus on furniture/interiors SMEs
	Practical exercises: 3DS MAX	Preview and introduction (general notions about display windows, views, use of standard navigation methods, selection methods, grouping, setting up unit of measurement...)
		Transformation commands
		Creation of primitive and composite objects
		Edit Commands and modifiers
		Importing files with other extensions
	Practical exercises: CORONA RENDERER	Main Features of the Corona Renderer module (introduction to the Photography and light behavior in reality and within the render engine, set up of Corona as default rendering engine of 3ds Max)
		Materials, "Material Editor". Set a standard material (Corona Mtl), how to apply the texture on the material (UV and Tiling)
		Settings, "Render Setup" windows. Workflow optimization
		Set reflections and refractions, adjust the distribution of light on the surface through Glossiness, Bump effect and its uses
		Concepts of lighting technology (creation and alteration of lights (Corona light), uses and Color temperature properties, creation of photographic setups for "Still Life" of objects of design (with Limbo Fotografico), import of files containing lighting information IES
		Camera placement (creation and editing of Standard Camera or Corona Camera, add camera's effects such as field blur (DOF) in post- production

Title of the Unit:	Telecommunications and data

Sub Units	Sections	
Internet of Things	Introduction to I.o.T	What is IoT?
		Related Concepts
		How does IoT work?
		Application of IoT
		Commercial Aspects
		Concerns (privacy, security, health, etc.)
	Features of IoT	Architecture
		Intelligence
		Automation
		Design
	Technologies of IoT	The Cloud
		Wired and wireless networks
		Cyber-physical systems
		Technological Standards
	Technologies related to IoT	Computational Semantics
		Rule Engines
		Big data and Analytics
	IoT framework: SOFIA2	The SOFIA2 environment
		Defining your architecture
		The SOFIA2 Console
		Connecting to the SIB
		Creating your own KP
		The information producer

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Title of the Unit:	Telecommunications and data

Sub Units	Sections	
		Rule definition
	Can you build your own IoT environment?	Test 1: Set up the server
		Test 2: Build the clients
		Test 3: Connectivity
		Test 4: Intelligence
		Conclusions
Integrated Systems	Theoretical aspects	Complexity theory
		Networks in complex systems
		Legacy and path dependency
		Convergence and divergence
		Synergy, adaptation and evolution
	Architecture	The service economy
		Service-oriented architecture
		Event-oriented architecture
		Modularity and self-organization
		System ecology
	Implementation	Middleware for distributed applications
		Integration topologies
		Integration challenges
Big Data & Analytics	Big data theory	Big data fundaments
		Big data platform
		Big data methodology
		Use cases and added value
	Big data technologies	Big data technologies I
		Big data technologies II
	Using big data	Data access
		Administration and data structures
		Advanced programming
	Analytics	Analytics fundaments
		Patterns, relationships and predictive modeling
		Data manipulation and machine learning
		Analytics technologies
Cloud Computing	Introduction	Definition
		Context in the Industry/Companies
		Main Characteristics
	Models of Cloud Computing	Infrastrucure as a Service (IaaS)
		Platform as a Service (PaaS)
		Software as a Service (SaaS)
		Emerging models
	Deployment models	Public
		Private
		Hybrid
		Community
		Advantages and disadvantages of Cloud Computing
		Business success stories
		Future of Cloud Computing in Industry
Communication Networks	Introduction	Definition
		Context in the Industry/Companies
	Industrial Communication networks (description and examples)	Body Area Networks (BAN): NFC, Bluetooth Low Energy, Bluetooth 4.0
		Personal Area Networks (PAN): Bluetooth, Zigbee.
		Local Area Networks (LAN): Ethernet, Industrial Ethernet, Rofbus, Profinet, M-Bus
		Wide Area Networks (WAN): GPRS, UMTS, LTE.
	Industrial Communication Standards	OPC UA
		Power Link
		Open Safety

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Title of the Unit:	Telecommunications and data

Sub Units	Sections	
		TCP/IP
		Use Cases
		Business Success Stories
		Future of Communication Networks in Industry.
Cyber-Security	Introduction	Definition
		Context in the Industry/Companies
	Types	User & Password
		Fingerprint
		Face Recognition
		Cryptography
		Federation
	Evaluation	Pentesting (Penetration testing
		Use Cases
		Business Success Stories
		Future of Cyber-Security

Title of the Unit:	Management Systems

Sub Units	Sections	
Application of Logistics	Table of Board of KPIs (Key Performance Indicators)	Introduction
		KPI Types
		Characteristics, how they must be
		KPI Incidence in Continuous Improvement
		Implementation and Follow-up Industry Furniture
	Data capture systems for plant processes control (RFID: Radio Frequency Identification…)	Definitions
		Types of RFID
		How does it work?
		Uses and Implementation Industry Furniture
Workflow management Systems	ERP (Enterprise Resource Planning)	Definition and Characteristics
		Types of ERP
		Uses and Implementation Industry Furniture
	Lean Manufacturing (workflow and improvement of manufacturing operations)	Introduction
		Basic Lean Tools
Collaborative Platforms	U2B (University to Business)	Identification of partners current mechanisms for U2B communication.
		Research into best practice and most successful cost-effective options for U2B communication.
		Recommendation of possible Platforms along with aggregation recommendations to include data from current partners' approaches
	U2S (University to Student) S2S (Student to Student)	Identification of partners current mechanisms for U2S and to enable S2S communication.
		Research into best practice and most successful cost-effective options for U2S and S2S communication.
		Recommendation of possible Platforms along with aggregation recommendations to include data from current partners' approaches

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Title of the Unit:	Standards, certifications and legal issues

Sub Units	Sections
Introduction to standardization	Definition
	Context in the industry/companies
	Why is standardization is an important issue?
State of art/challenges in standardization in I4.0	
Consortiums and organisations	IEC/ISO
	IETF/W3C
	DKE/DIN
	ETSI/CENELEC/CEN
Working Group Committees	CyberSecurity, industrial networks
	Automation Systems and Integration
	Robots and Robotic devices
	Sensor Networks
	Internet of Things
	Big Data
	Cloud Computing and Distributed Platforms
How to apply standards to factories interested in Industry 4.0	

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