IN4WOOD

Industry 4.0 for Wood and Furniture Manufacturers

Deliverable 1.2.: Report of the need of the furniture industry regarding KET of I4.0 Version 1

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

Partners

P1	Centro Tecnológico del Mueble y la Madera de la Región de Murcia	CETEM	ES
P2	INDRA Sistemas, S.A.	INDRA	ES
P3	Universidad Politécnica de Cartagena	UPCT	ES
P4	British Furniture Manufacturers	BFM	UK
P5	Ion Technologies Ltd	ION	UK
P6	Occupational Awards Limited	OAL	UK
P7	Centro Sperimentale del Mobile e dell'arredamento	CSM	IT
P8	Scuola Superiore di Studi Universitari e di Perfezionamento Sant'anna	SSSA	IT
P9	Internationaler Verein für Technische Holzfragen e.V.	Ivth	DE
P10	Karlsruher Institut Fuer Technologie	KIT	DE
P11	European Association of Development Agencies	EURADA	BE
P12	Regional Service for Training and Employment	SEF	ES
P13	PILDOREA	PILDOREA	ES

Prepared	Verifed	Approved
CSM	CETEM	All Partners

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

Table of Track Changes

Version	Date	Changes
1	20th October 2017	Draft version of the document
2	10th November 2017	Document revised by leader
3	30th November 2017	Definitive version of the document

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

Table of Contents

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

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 customisation, 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 into the production chain is a key enabler if the European Furniture and Woodworking industries are to remain competitive. This, coupled with a lack of staff qualifications, an ageing workforce and the industries' inability to attract young workers[3] remain crucial points for these industries. To boost the recruitment of highly skilled staff requires initiatives addressing training to make the sector attractive and to transform both the academic knowledge, transferable and high-level basic and advanced technical competences to be useful and applicable in the future.

Main Purpose

The furniture and wood sector has identified that it has a shortage of professionals with high-level qualifications in ICTs and other emerging technologies. Some of the specific skills and competencies

[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.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

that are seen as critical for managers in the furniture sector are ICTs skills that are essential for operation in a modern business environment.[4]

This document details the results that Vocational Education and Training (VET) providers and sector experts from the In4Wood consortium obtained about the shortfalls and needs regarding Key Enabling Technologies (KETs) that Industry 4.0 (I.40) involves in terms of skills and competences, paying special attention to the Furniture and Woodworking sectors. The analysis has been carried out in the countries represented in In4Wood consortium: Spain, Italy, Germany and UK, with a total production of furniture equal to 53€billion (more than half the total share of EU28)[5], and centered on professionals from the sectors, representatives from Higher Education and Vocational Education and Training communities dealing with (Information and Communications Technology (ICT) and Furniture/Woodworking related studies, and experts from Key Emerging Technologies. With this, the first milestone of the In4Wood project, *Definition of Skills Needs,* has been achieved.

This analysis will be further used by the VET providers of the Consortium for the design of the most suitable training paths for the identified target users as well as for profiling the Joint Curriculum Vitae on Industry 4.0 expertise in the wood and furniture manufacturing sector.

Methodology

The analysis has been carried out via online surveys addressing 3 clusters of target respondents specifically relating to the furniture and wood manufacturing world: furniture manufacturers (mainly managers and key roles in furniture and wood manufacturing companies have been interviewed); VET/Higher Education (HE) communities; and KET experts. The analysis across 4 countries, Spain, Italy, UK and Germany with a total of 600 responses which can be considered as a robust and credible sample and enough for the results to be reliable and representative. Responses received have then been elaborated on in the following concepts and findings.

Key findings

The main results are related to the specific national sectoral features for the various levels of implementation of KETs: medium to large sized companies in Germany are much more focused on the application of KETs in the production process with attention to automation and robotics; whereas than small and medium enterprises (SMEs) in UK and Spain which have a higher focus on the entire manufacturing process including logistics and delivery; and SMEs in Italy concentrate on the application of KETs to other essential business support functions and processes including marketing, sales and after-sales, rather than the production process.

Results evidence **a lack of digital business strategy among furniture industries**, especially SMEs, demonstrating a poor involvement in the Internet of Things and in the use of cloud solutions.

[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.

[5] Source: (data 2015) https://www.statista.com/statistics/456496/production-value-manufacturing-furniture-european-union-eu/

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

The biggest barrier for the implementation of I4.0 technologies in all these contexts **is the lack of knowledge and skills among staff**, along with **insufficient training** in the topic and the **high cost of implementing such technologies**.

Research found that specific training programmes relating to the furniture and wood manufacturing sectors are not actually focused on I4.0 KETs in any of the countries sampled.

This is also the reason why most of answers coming from VET/HE communities state that they have experiences in the application of KETs in the business world but rarely in the sectors focused by In4wood.

The clear evidence of the gap in current training programmes which promote the implementation of new technologies in traditional manufacturing sectors amplifies and reinforces the urgent need to develop more appropriate training solutions to meet this demand.

Training programmes using a blended learning formula should be focused on Additive Manufacturing, Augmented Reality, System Integration and Internet of Things mainly as most of manufacturers cited that in the next 5 years IoT and IIoT will become more strategically important, especially for using data and sensors to make decisions and interact (human/machine interaction and producer/consumer interaction). Most respondents also believe that robotic solutions will bring improved efficiency in productivity, product quality, waste reduction and safety as these technologies will support the simplification of manufacturing processes and bring about smarter working practices.

Key suggestions / key actions

During this Work Package (WP1), the first steps for harmonising the future training content with existing qualification profiles has been carried out. The desk research performed within each national body and ESCO competences analysed the professional qualifications and competences related to furniture and woodworking in each country and in Europe. This process has identified those qualifications related to In4Wood and their target users, detailing all the skills and competences that these qualifications are addressing.

National skills profiles, which will be addressed and implemented with KET-related skills and competences as a result of In4wood training materials are generally at EQF level 3, 4 and 5. These are summarised in: 2 managers' profiles for Spain (Organisation and Production Management in the furniture and carpentry industries, Manufacturing Planning and Management in wood and cork industries; 2 Technician Profiles for Italy (Senior Technician for Design and Industrial Design, Senior Technician for Process, Product, Communication and Marketing Technician for the Furniture Industry), 2 current technical roles for the UK – Furniture Manufacturer (Carpenter) and Upholsterer - with a view to supporting the development of 3 new Technical Profiles for the UK (Furniture Production Manager, Furniture Product Developer and Furniture Design Technician); and 4 technical

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

profiles for Germany (Woodworking Mechanic, Wood Processing Mechanic, Carpenter, Upholsterer).

There are clear differences in selected profiles in each country, which normally relate to the differences that the furniture and wood working manufacturing sectors have in terms of structure, size of companies, specific market focus (mass production or high end production) and finally the typologies of products and materials.

Generally, it is evident that National Profiles, even if they are periodically revised, are in all countries, related to traditional competences. They rarely consider or include the advanced competences and skills relating to Industry 4.0 technologies that are demanded from the future labour force. In this phase of implementation, **In4wood has a key role in revising profiles and opening a debate in each country** by involving key national contact points for the European Tools EQF, ECVET and EQAVET in order to analyse and eventually **approve the integrated profiles** that In4wood will generate.

The results of the analysis will also be **integrated into the national studies** and surveys related to R&D, funding schemes, strategic planning documents. For instance: the action of revising national Smart Specialisation Strategies that each country is working on with a view to 2020-2024 European funding framework, **should consider this information on Industry 4.0 for traditional manufacturing sectors like furniture and woodworking**.

National and European Training schemes and programmes should be approached, along with **R&D competitiveness** for SMEs and **innovation topics**; starting from this point of view, **results will be shared at each national level** by In4wood partners with main stakeholders and other relevant partnerships.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

2. Introduction on data analysis: which outcome for which purpose

The outcome of the D1.2 relates mainly to a report on Higher Education (HE) Resources for Vocational Education and Training (VET) on Furniture Manufacture and to report on skills deficiencies within the furniture manufacturing system.

The results analysis will define the lacking, needed and requested competences and skills with specific attention to Key Enabling Technologies (hereinafter, KETs) of Industry 4.0 (hereinafter, I4.0) in the furniture sector all over Europe. It will analyse 4 main cases from Spain, Italy, Germany and UK (Italy has the highest furniture production and turnover in 2015 with 21 billion euro; Germany second with 20.6 billion euro, UK third with 11 billion euro, France fifth after Poland with 7 billion euro and Spain the sixth with 4.7 billion euro (CSIL 2017). The specific national features of the sector are described in the first section of the dataset analysis. For example the responding companies' size and specific typology of production affect the results; thus this information has been also considered when evaluating answers and weighted accordingly.

The 3 questionnaires are aimed at verifying the knowledge level from several points of view within the European furniture-manufacturing sector by using the 4 partner countries as a pilot sample.

When comparing each country, the furniture sector has diverse structures and differences because the company typologies are addressing multiple markets and thus expressing needs, which are not always the same or aligned.

This information is essential in creating a better understanding of the nature of the sector in each national context. It enables the addressing of professional/vocational education in a more specific way, answering to sectoral training needs in relation to I4.0 KETs according to answers given.

This forms the basis for the development of training materials as well as the:

- **Definition of a common curriculum** that can be designed to integrate I4.0 KETs in the furniture industry by the application of training programmes.
- Integration of deficient skills and competences in existing National Qualification Frameworks and National Qualification Profiles (hereinafter, NQF and NQP respectively) relating to the furniture manufacturing sector, with a view to the possible harmonisation with National Qualification profiles provided in annexes 5, 6, 7 and 8.

This document is the second output of WP1 "Definition of skills needs" where a detailed analysis of the furniture sector regarding the lack of knowledge and skills in I4.0 is a required output of IN4WOOD project.

In the second part of WP1, the sector experts and social partners have been asked to evaluate the current state of their national industry's skills regarding different key enabling technologies under

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

the umbrella of the I4.0 concept. Then both, VET providers[6] and sector experts[7] have performed desk research and developed questionnaires to analyse the skills needs regarding I4.0. WP1 closes with the achievement of Milestone 1: Definition of skills needs.

Tasks from 1.1 to 1.3 have been carried out linked to the first part of WP1 - at the end of which D1.1 was released. These activities were regularly carried out from month 1 (November 2016) to month 5 (March 2017). Starting from month 5, partners were asked to disseminate the surveys content in order to gather the maximum of answers.

The final part of WP1 relates to the following tasks:

T1.4: Gaining Data on the needs of the Furniture Manufactures of KET of I4.0 (M5-M8)

Leader: CSM. Participants: CETEM, iVTH, BFM

T1.5: Gaining Data on the resources available in the HE and VET Institutions related to KET of I4.0 (M5-M8)

The process has been coordinated by CSM. Participants: UPCT, INDRA, KIT, SSSA- BIOROBOTICS and IONology

T1.6: Gaining Data on the commercial available products related to KET of I4.0 (M5-M8)

The process has been coordinated by INDRA. Participants: UPCT, INDRA, KIT, SSSA-BIOROBOTICS and IONology

The partnership was also involved in the activity by providing extra support to both VET/HE communities and furniture manufacturers in accessing the Flexmail[8] tool and briefing them on how to submit responses. In most of the cases and all countries involved, SMEs manufacturers have demonstrated the need of assistance given in understanding the purpose of the survey and the provision of coherent responses. Industry 4.0 topics was not an easy topic for SMEs to respond to. Even if SME managers were involved in I4.0, they lacked a detailed knowledge and understand of I4.0. The questionnaires were specifically designed to be as detailed as possible so as to provide the best possible data about skills and knowledge gaps and deficiencies.

The need for more training was emphasised much more than expected. On the other side, the involvement of VET/HE communities was related to the possibility of meeting students and teachers on a face to face basis so that they could be fully briefed.

T1.7: Analysis of data gained (M8-M9)

Leader: CSM. Participants: CETEM, iVTH, BFM

[6] VET PROVIDERS: UPCT, IONOLOGY, KIT, SSSA-BIOROB, INDRA, PILDOREA
[7] SECTOR EXPERTS: CETEM, CSM, iVTH, BFM
[8] www.flexmail.be

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

WP Leader together with project Leader defined the analysis methodology which takes into account: (1) analysis of each question and related responses for the 3 questionnaires and design of appropriate charts/graphs (see annexes 1, 2, 3); (2) the evaluation of results as the main output (point 3 of this report).

T1.8: Writing of WP1 report for application within the project. (M9-M10)

Leader: CSM. Participants: CSM

The report has been continuously reviewed and revised to ensure that it providers a thorough and complete evaluation on which the next project steps will be based.

T1.9 Harmonise skills needs/competencies (M9-M10)

Leader: CSM. Participants: PROSKILLS, SEF

During this task, CSM with the cooperation of all partners verified existing NQF and NQP in order to define which professional and educational profiles lacked skills and competences relating to I4.0 KETs and could therefore be integrated in the future. The result of this is point 4 and 5 of this deliverable.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

3. The methodology used to gather answers

The 3 questionnaires developed as a result of D1.1 have been translated in all consortium languages (English, German, Spanish, Italian) with the addition of French in relation to EURADA's participation to the partnership and then uploaded onto the shared platform.

During the Steering Committee that took place in Florence in April 2017 the partnership evaluated 2 platforms: www.lime.com and www.flexmail.eu

The selection of Flexmail was agreed because it was felt that it had a better design, was user-friendly for uploading content, and offered an robust admin function for checking ongoing results. Flexmail also has more robust security for the management and protection of the data.

To ensure that the questionnaires were stable and that there was no errors or functional issues, partners tested the survey using the administrative facility. Content and functioning of the draft questionnaires were verified by CSM before the public launch.

Before the launch of the 3 questionnaires (VET/HE communities, furniture manufacturers and KETs' experts) each partner defined specific in-country promotional actions so that they could reach the maximum target audience possible. These plans are shown in Annex 4 in D1.1.

Starting from July 2017, the partnership decided to implement a programme of direct contact, especially furniture manufacturers. This involved direct calls with questionnaires completed on the phone with the support of various and trusted intermediary organisations; hardcopy paper questionnaires were completed at various events and meetings with the responses then uploaded by partners at a later stage.

For the analysis stage, excel files derived from the Flexmail data platform were used to compare answers provided by each country's respondents.

Then the harmonisation with NQF and NQP was completed using the information and evaluation sent by each partner regarding their own national profiles.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

4. Dataset: questions and answers received per country per (furniture manufacturers, VET/HE communities, KETs experts)

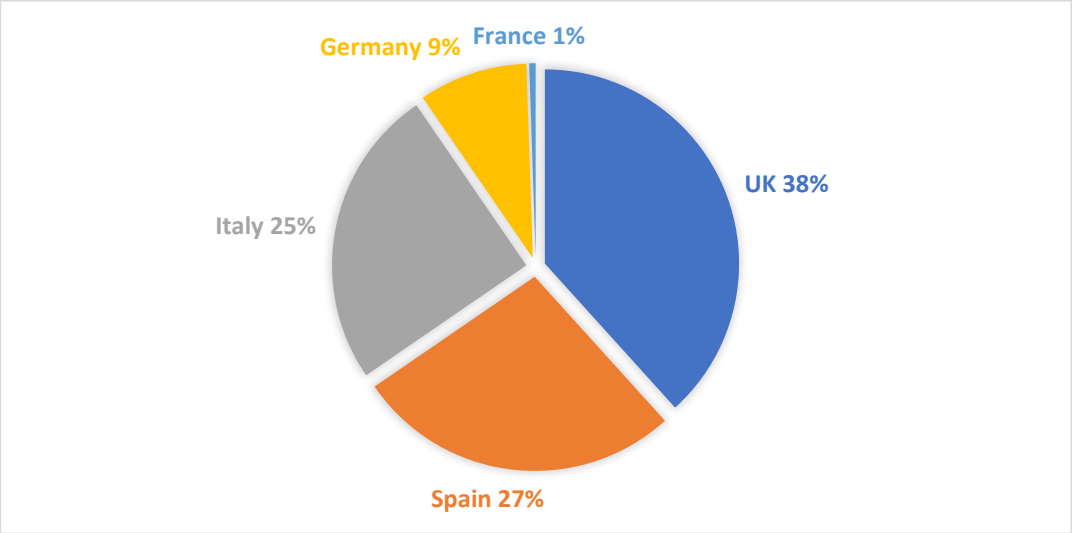
The furniture sector has a differentiated structure each country with typologies of companies addressing multiple markets and thus expressing needs, which are not always the same.

This information is essential in order to better understand the nature of the sector in each national context and address the topic of professional education in a more specific way by answering to sectoral training needs in relation to I4.0 KETs according to answers given.

4.1 Data analysis on the needs of the furniture manufacturers of KET of I4.0

(ref. Annex 1)

Origin of answers

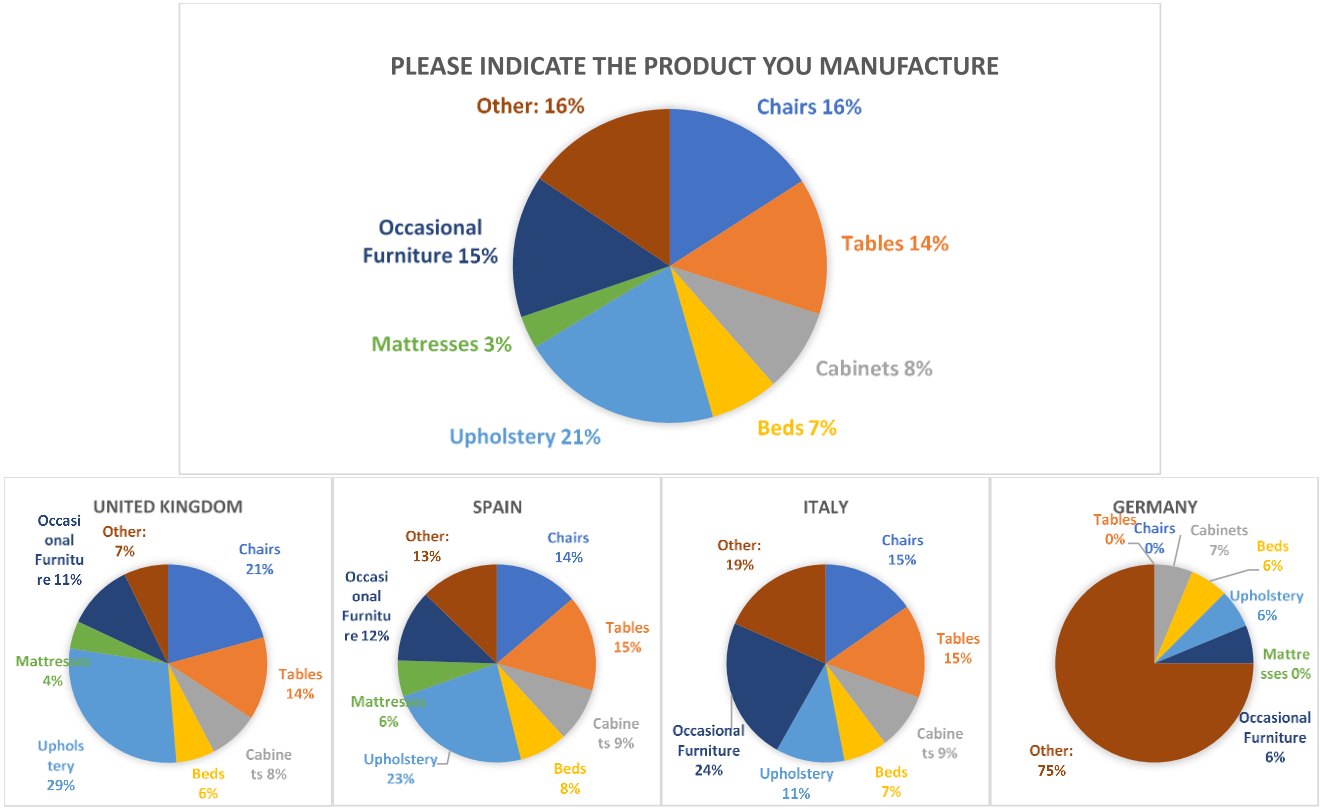


Graphic 1: Origin of answers.

Out of the answers received from managers of furniture manufacturing companies 38% of answers came from UK, 27% from Spain, 25% from Italy and 9% from Germany.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

Typology of production



Graphic 2: Types of production [overall and by country].

Upholstery is the most represented sub sector (21%) followed by chairs (16%), occasional furniture (15%) and tables. Cabinet manufacturers represent 8% of the respondents, while beds and mattresses, 7% and 3% respectively.

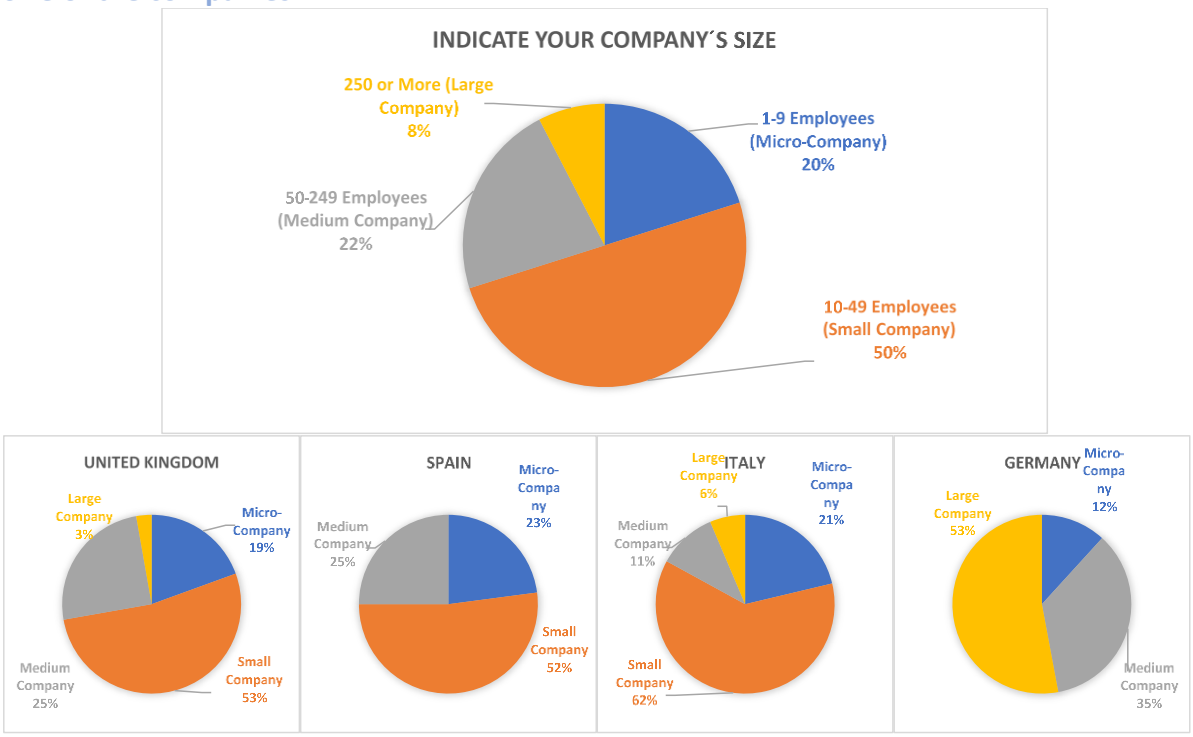
Within the "Other" category, represented by 16% of the respondents, can be found manufacturers of wooden doors, kitchen and bath furniture, outdoor furniture, cribs and children furniture, school furniture, prefabricated houses, suppliers of timber and other raw materials and furniture components.

In the UK and Spain, the core of manufacturers represent producers of upholstered furniture, tables, chairs and occasional furniture; whilst in Italy most are manufacturers of occasional furniture (small tables, nightstands, chests, commodes, etc.). Most 'Other' products are located within Germany.

61% of companies work within the national market and this is reflected in the specific demand their offer answers to; their need for innovation and differentiation is related to their internal market and not to the international market competition. 38% of companies are small in size, followed by micro and medium sized companies. 50% state their turnover is increasing which is reflected through the possibility and interest in growing their market share and business with the acquisition of new skills.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

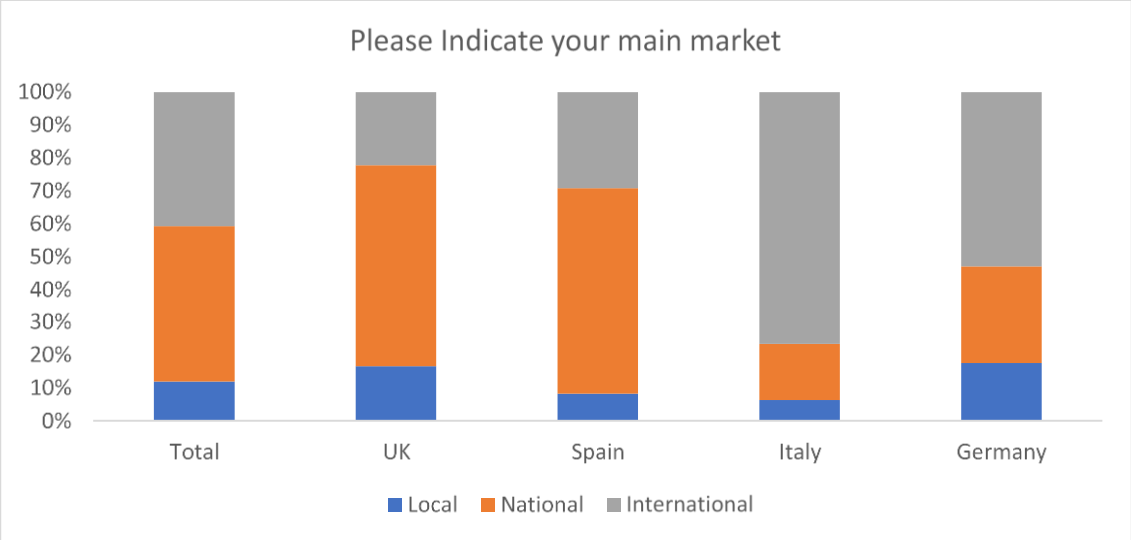
Size of the companies



Graphic 3: Size of companies [total and by country].

50% of respondents work for small sized companies. Those companies with less than 10 employees are 20% of the overall total. This distribution is very similar for those respondents coming from the UK, Spain and Italy; the vast majority of large employer respondents are from Germany.

Main Markets

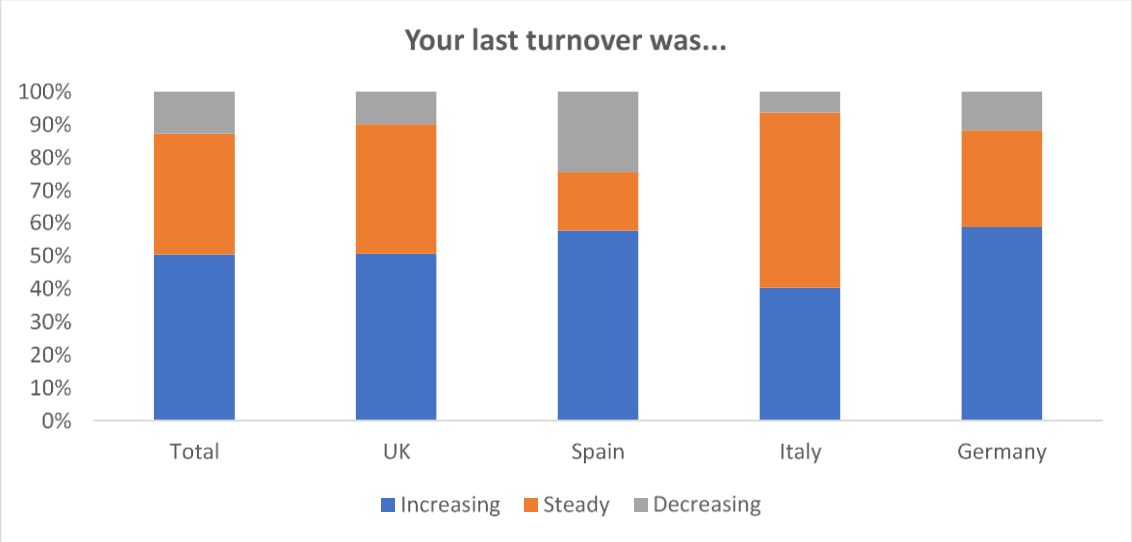


Graphic 4: Main markets.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

59% of all respondents mainly work on the local and national markets. Respondents from Italy and Germany have more companies addressing international markets.

Turnover



Graphic 5: Turnover.

The general overview provided by furniture manufacturers shows the majority of companies in a stable to increasing turnover situation, thus the possibility for these companies of thinking about the need of internal competences is much higher than for those employers in other market conditions. Compared to companies who are facing a decreasing turnover situation are concentrating on solving daily operational problems, whereas companies which are are growing their turnover and increasing their market share are much more comfortable with the idea of developing internal processes, with the acquisition of new competences and skills in order to differentiate themselves - especially when it comes to the tough international competition they face.

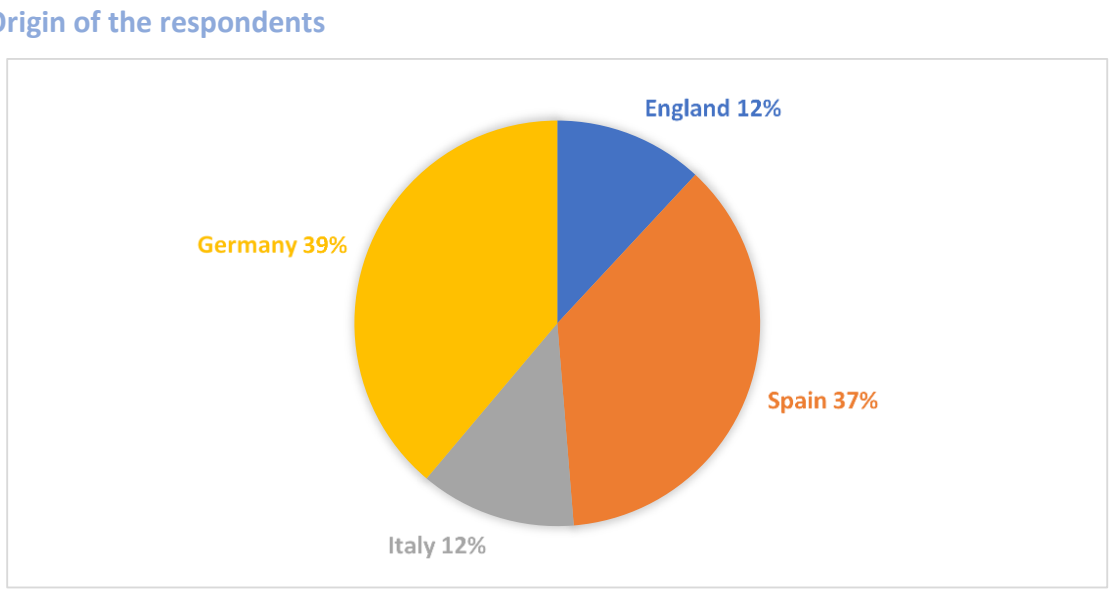
4.2 Data analysis on the resources available in the HE and VET institutions related to KET of I4.0

(ref. Annex 2)

Answers received from the VET/HE communities in each partner country are divided as follows per country:

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union



Graphic 6: VET/HE institutions' answers per country.

The level of education of interviewed people is represented mainly as follows:

- UK 33% VET 33% PHD
- IT 69% bachelor
- SP 35% bachelor 32% VET
- DE 41% bachelor

And most of those interviewed have been trained on the following topics:

- UK 42% IT
- IT 50% INDUSTRIAL ENGINEERING
- SP 66% IT
- DE 49% OTHER

Competences are mainly related to IT/computer science world, thus very much focused on industry 4.0 topics. Their perception of the importance of KET related skills and competences in the furniture industry is particularly valuable.

In addition to this, the evaluation provided by the core of respondents in Italy are from the world of industrial engineering which brings a closer perception in relation to the specific sector needs.

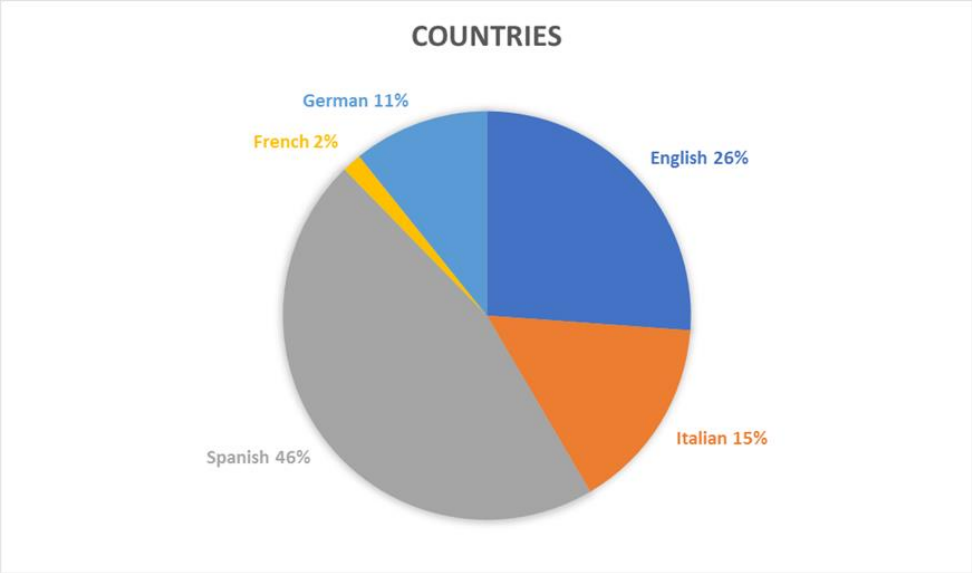
All answers swing on one side from more technological competences, and on the other side, more industrial related competences.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

4.3 Data analysis on the perception of KET experts

(ref. Annex 3)

Answers received from KET experts which were involved according to the knowledge they have in relation to available technologies and to those technologies that are actually used or of interest for the furniture manufacturing sector, are broken down as follows:



Graphic 7: KET´s experts answers per country.

KET Expert respondents come from these specific set of competences and specialisation topics in relation to KETs in Industry 4.0:

UK: big data, Cyber Security, system integration, IoT, additive manufacturing and cloud computing.

IT: IoT, augmented reality, system integration, cloud computing, simulation, big data.

DE: augmented reality, Cyber Security, system integration, IoT, autonomous robots, simulation, additive manufacturing and big data.

ES: system integration, IoT, cloud computing, and all other competences represented at the same level.

Above information shows that all competences in KETs of Industry 4.0 have been covered by the group of KETs' experts interviewed in order to get a complete range of responses in relation to the use of KETs within the furniture manufacturing sector; the level of knowledge and skills existing in the sector and finally to the more interesting technologies for the sector itself in which specific training programmes should be developed.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

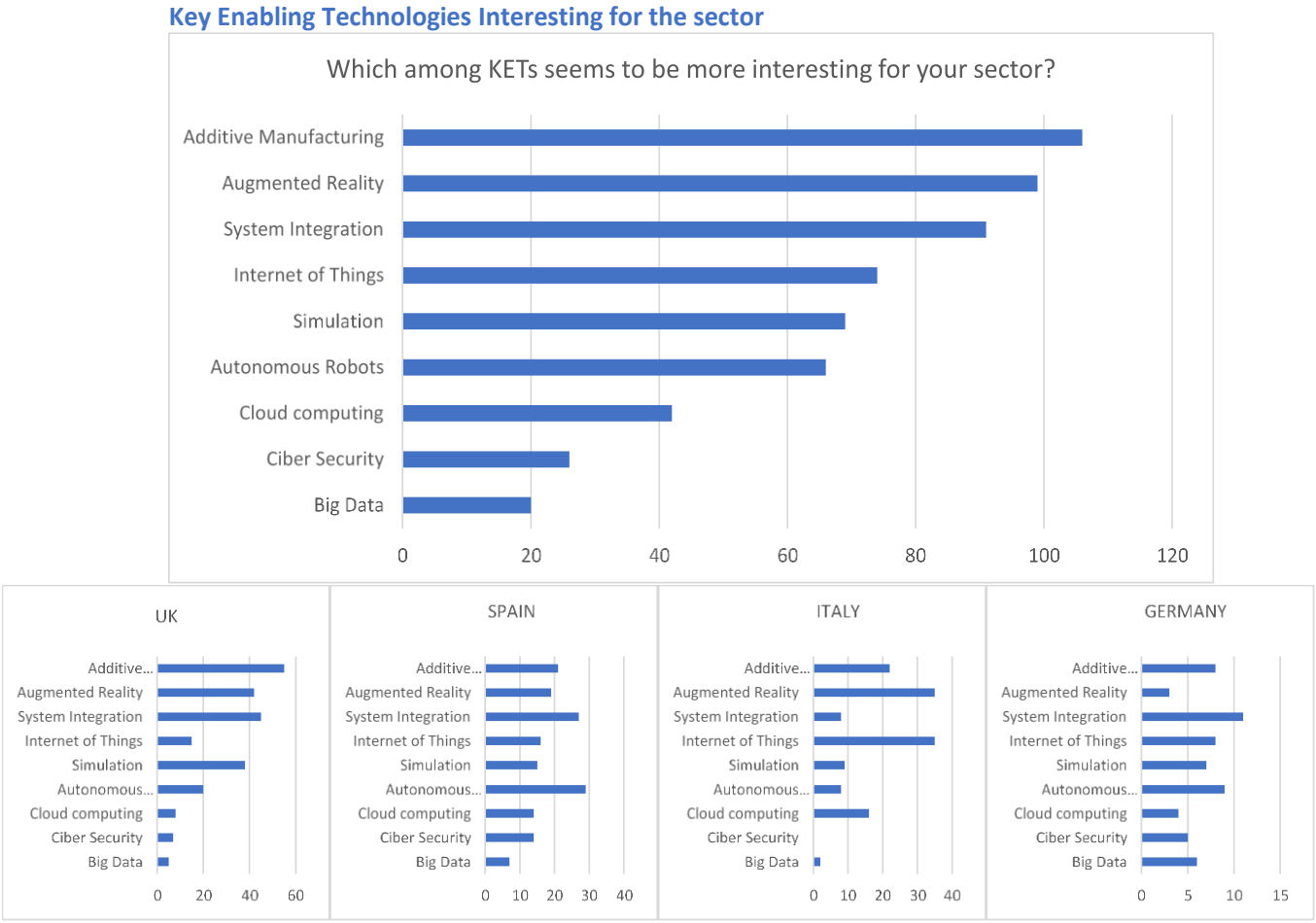
5. Key information deriving from the analysis: existing and deficient competences related to I4.0 KETs for furniture manufacturers, resources from VET/HE communities and analysis of existing competences from KETs experts

The following is a description on the main output of information related to the existing and deficient competences related to KETs in Industry 4.0. Data is shown for the 3 respondent cohorts per country or aggregated according to results.

5.1 Furniture Manufacturers.

(ref. Annex 1)

Furniture manufacturers were asked which among KETs are interesting for the sector and they answered as follows:



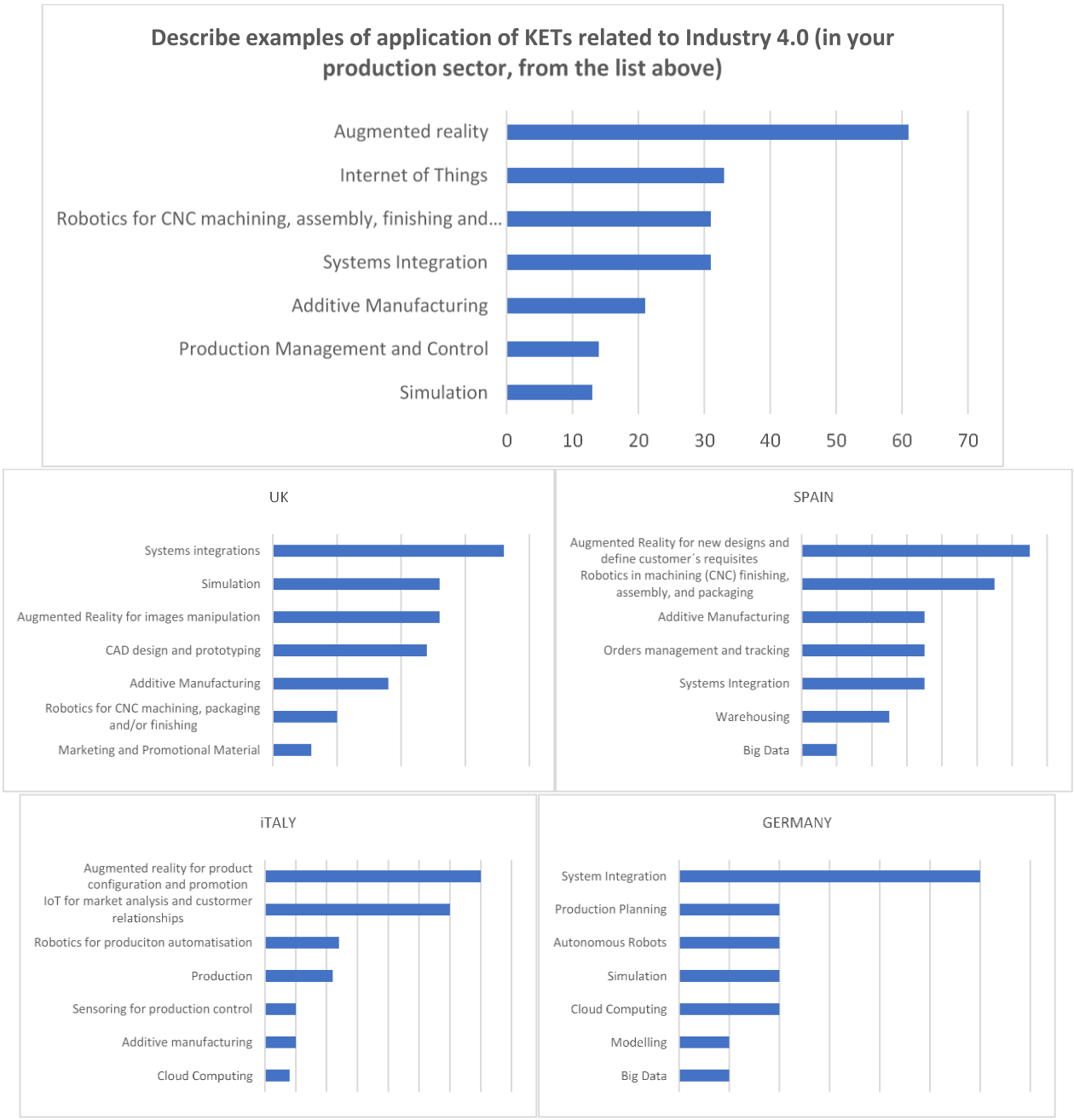
Graphic 8: Interesting KETs in the Furniture Sector [overall and by country].

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

The manufacturers describe a diffused use of computer in their companies especially in relation to the following processes: 3D, design and engineering, manufacturing, orders, BoM, sales processing.

Awareness on Technologies Application.

Mentioned examples of application of KETs in the sector are mainly AdditiveManufacturing, System Integration, Augmented Reality/ Also included are marketing and promotion, 3D printing, CNC and Automisation with Robots, IoT.



Graphic 9: Examples of application of KETs in the Furniture Industry [overall and by country].

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

Direct Experience

UK manufacturers cited that they have experience in the application of KETs in 59% of cases in relation to system integration, additive manufacturing, prototyping.

Italian manufacturers cited that they have experience in the application of KETs in 53% of cases with reference to the management of orders, production process and relationship with client and market analysis.

Spanish manufacturers cited that they have experience in the application of KETs in 47% of cases with reference to management of orders, production, application of sensors.

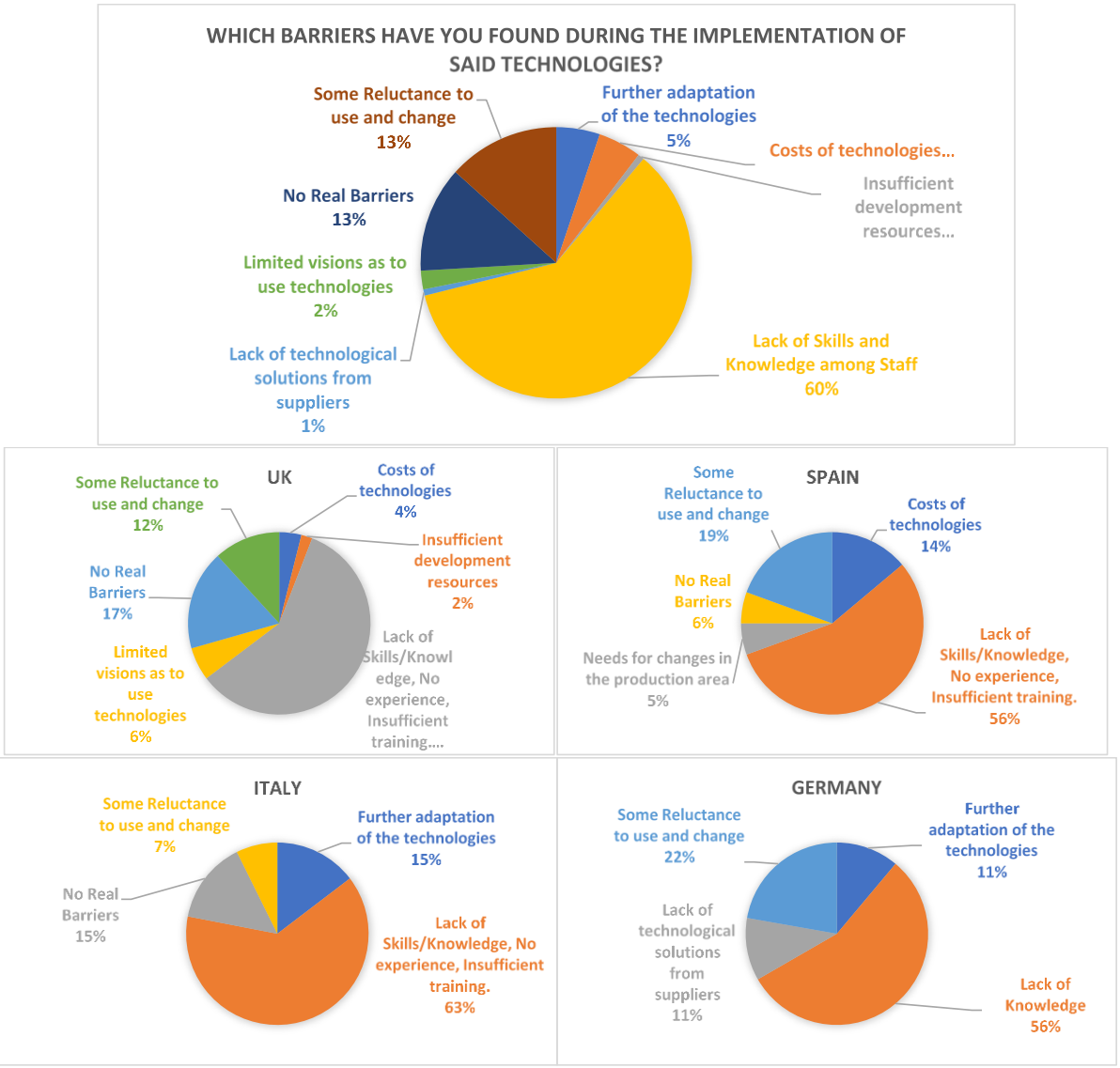
German manufacturers interviewed cited that they have already applied KETs in 53% of cases and mainly in relation to production and order processing.

The main barriers to the application of KETs are cited as a lack of staff knowledge and failing readiness in accepting the introduction of technologies, a lack of skills, insufficient training and the implementation cost of such technologies.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

Barriers at implementing KETs in the Furniture and Woodworking Industries



Graphic 10: Barriers at implementing KETs in Furniture and Woodworking Industries.

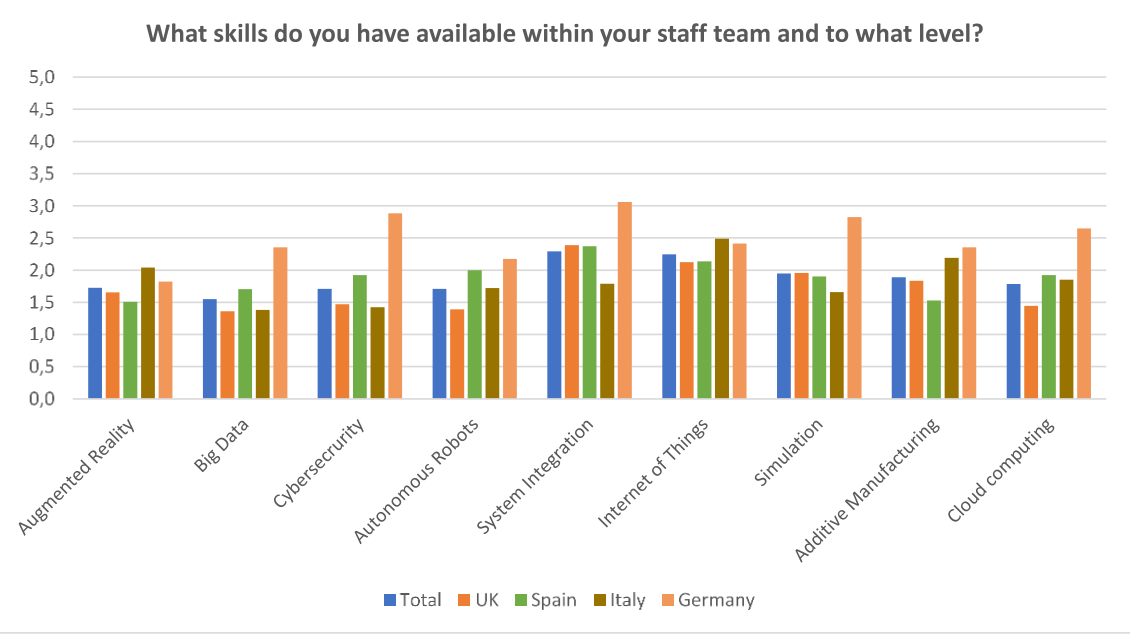
This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

Skills Available in the Company:

Furniture manufacturers were asked to evaluate the level of skills already available in their companies. The following results demonstrate the lack of required high-level skills:

Workers' skills



Graphic 11: Workers´ skills.

UK

SKILLS	LEVEL
Augmented reality	59% rate 1 (poor)
Big data	84% rate 1
Cyber Security	76% rate 1
Autonomous robots	79% rate 1
System integration	39% rate 2, 37% rate 3
IoT	30% rate 1, 43% rate 2
Simulation	42% rate 1, 27% rate 2, 21% rate 3
Additive manufacturing	50% rate 1
Cloud computing	75% rate 1

ITALY

SKILLS	LEVEL
Augmented reality	29% rate 1, 46% rate 2
Big data	76% rate 1
Cyber Security	76% rate 1
Autonomous robots	57% rate 1
System integration	53% rate 1
IoT	40% rate 2, 21% rate 3
Simulation	57% rate 1
Additive manufacturing	38% rate 2, 12% rate 3, 12% rate 4
Cloud computing	42% rate 1, 38% rate 2

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

SPAIN

SKILLS	LEVEL
Augmented reality	69% rate 1
Big data	56% rate 1
Cyber Security	41% rate 1, 28% rate 2, 25% rate 3
Autonomous robots	43% rate 1, 33% rate 3
System integration	20% rate 3, 20% rate 4
IoT	33% rate 1, 30% rate 2
Simulation	48% rate 1
Additive manufacturing	64% rate 1
Cloud computing	46% rate 1

GERMANY

SKILLS	LEVEL
Augmented reality	52% rate 1, 23% rate 3
Big data	29% rate 2, 35% rate 3
Cyber Security	47% rate 3
Autonomous robots	35% rate 1, 29% rate 2, 23% rate 3
System integration	29% rate 3, 47% rate 4
IoT	35% rate 1, 41% rate 3, 17% rate 4
Simulation	35% rate 3, 23% rate 4
Additive manufacturing	23% rate 1, 29% rate 2, 35% rate 3
Cloud computing	35% rate 2, 29% rate 3, 23% rate 4

The general situation shows an average lack of skills related to KETs of Industry 4.0 especially in those countries, UK, SPAIN, ITALY, especially in SMEs.

The case of Germany, most of the responding companies were mainly big or medium sized and is best described according to the manufacturing system they employ: bigger organisations and structured companies have higher level internal competences especially in BIG DATA, CYBER SECURITY, SYSTEM INTEGRATION, IOT, SIMULATION, ADDITIVE MANUFACTURING AND CLOUD COMPUTING. For each of these topics they have cited at least a 'medium' level of knowledge (more than 20% of companies rating 3).

Even if most of the skills exist internally, German companies externally source for more expertise in more than 25% of cases (at a high level rating 5) for system integration, additive manufacturing and cloud computing.

SMEs, making the core of furniture manufacturing companies interviewed in other countries declare they have the following internal skills:

UK: SYSTEM INTEGRATION, SIMULATION, with over 20% of answers rating 3 (medium). Some knowledge also exists for IOT where 43% rate 2.

As a direct consequence the skills/knowledge sourced from outside are mainly related to BIG DATA, AUTONOMOUS ROBOTS, CYBER SECURITY, CLOUD COMPUTING, AUGMENTED REALITY, ADDITIVE COMPUTING (for which more than 40% has rated 5).

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

ITALY: AUGMENTED REALITY, IOT, ADDITIVE MANUFACTURING AND CLOUD COMPUTING. Only in the case of IoT, more than 20% of companies rated 3. Level 4 is rated only in case of additive manufacturing for 12% of answers. All other topics rate more than 2.

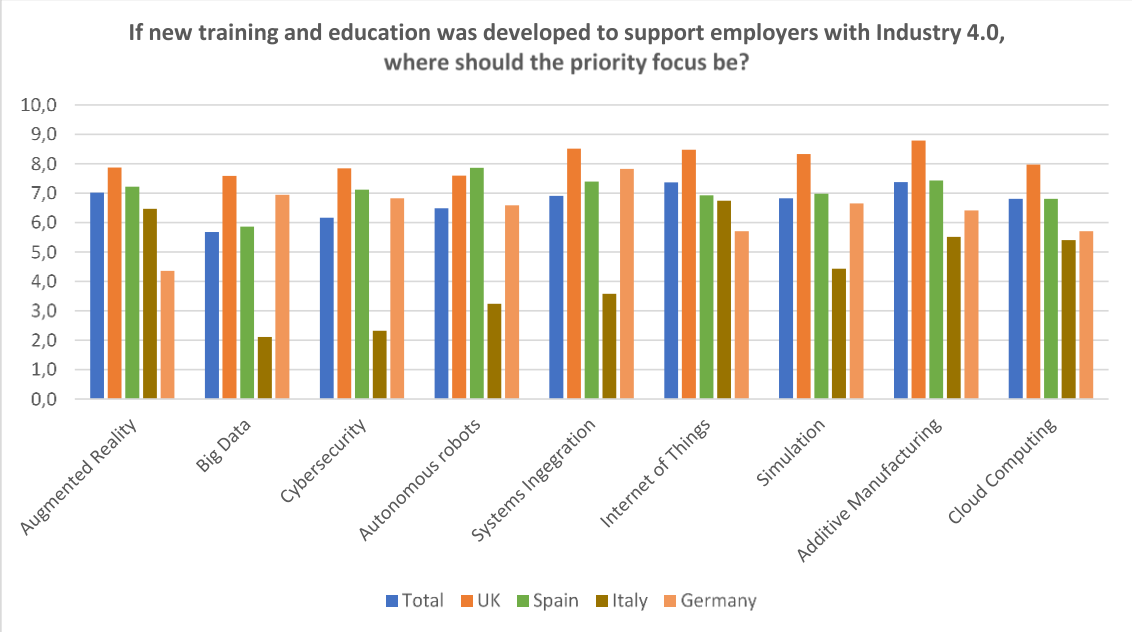
For Italian companies, any skills which are lacking are not sourced externally because they are not actually used: IoT is sourced externally at a medium level (rate 3) for 34% of answers, additive manufacturing for 23%, cloud computing for 21% and augmented reality for 19% still at a medium level.

SPAIN: CYBER SECURITY, AUTONOMOUS ROBOTS, SYSTEM INTEGRATION. Only system integration is rated 4 (good level of knowledge) in 20% of answers. Cyber Security and autonomous robots are rated 3 in more than 20% of answers, while IoT reaches 30% of rate 2.

Almost the same situation happens in Spain as it does in Italy, where skills are sourced at a medium level (rate 3) for cloud computing and IoT in more than 35% of cases; all other competences for more than 22% of cases still at a medium level of need.

Most Interesting Technologies for Future Training Programmes

Priorities in training and education about I4.0 to support employers



Graphic 12:Priorities in training and education about I4.0 to support employers

From more interesting to less interesting per country:

- **UK**: ADDITIVE MANUFACTURING, IOT, SYSTEM INTEGRATION, SIMULATION (more than 40% rate 10 as maximum need), than AUGMENTED REALITY, CYBER SECURITY and AUTONOMOUS ROBOTS (more than 25% rating 10).

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

- **ITALY**: AUGMENTED REALITY (more than 53% rating 10), then cloud computing, IoT more than 40% rating 10
- **SPAIN**: AUTONOMOUS ROBOTS (the only case rating 10 for 43% of answers), then AUGMENTED REALITY and ADDITIVE MANUFACTURING rating 10 for more than 28%, then cyber security, system integration and simulation for more than 20% rating 10.
- **GERMANY**: SYSTEM INTEGRATION, AUTONOMOUS ROBOTS go over 29% of answers in rating 10 the need of training; CYBER SECURITY more than 23% rating 10. Other topics are less requested.

Type of Suitable Training:

Most of the responding manufacturers would appreciate onsite taught training programmes (UK), blended learning (ITALY, SPAIN and GERMANY)

Achieved Results from The Application Of KETs (Innovation and Market Level) And Direct Contact with Research Centres Specialised In I4.0:

At **innovation level**, main results are related to:

IMPROVED PRODUCT QUALITY, REDUCTION OF COST AND WASTE, IMPROVED DESIGN, EFFICIENCY AND CONTROL, REDUCTION OF STOCKS, HIGHER KNOWLEDGE OF MARET NEEDS, FASTER DEVELOPMENT OF NEW PRODUCTS.

At **market level**, main results are related to:

IMPROVED QUALITY → INCREASED REPUTATION FOR THE COMPANY

REDUCED LEADTIMES → ADDITIONAL SALES

HIGHER COMPETITIVENESS → IMPROVED PRODUCTIVITY AND MARKET REACH

The majority of UK furniture manufacturers (72%) have never had contact with research centres specialised in I4.0; while 61% of Spanish, 55% of Italians and 47% of Germans have.

In all positive answers, the centres are mainly local or national, rarely international.

In all cases, the main focus of this cooperation has been the PARTICIPATION to an R&D INITIATIVE (47% of UK, 39% of Italy, 36% of Spain) or a COLLABORATIVE PROJECT (34% of Spain, 31% of Germany) both at regional or national level.

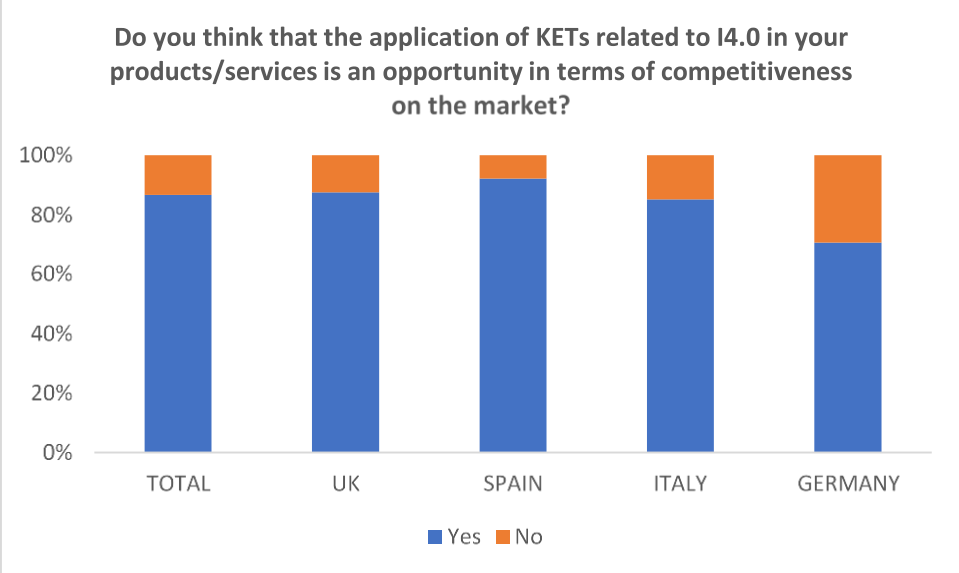
The Application of KETs for Furniture Manufacturers:

Furniture manufacturers stated generally that the application of KETs is an opportunity for their businesses in both national (including local) and international markets.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

I4.0 and the competitiveness in the market



Graphic 13: I4.0 and business Competitiveness.

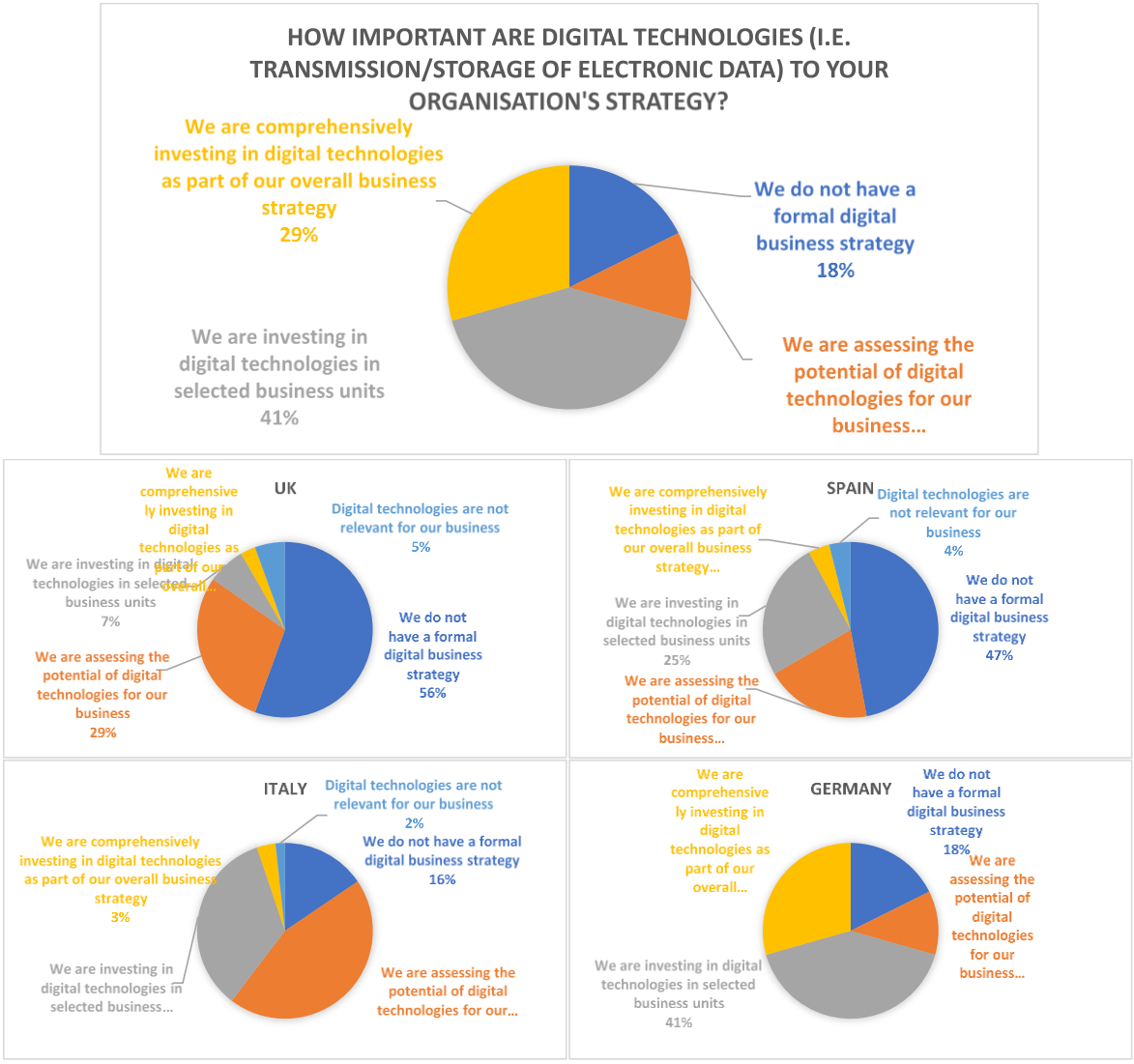
Responding manufacturers have stated, that considering that I4.0 technologies are based on the merger of real and virtual world in factories, that the following points should be considered as advantages in the field of the furniture manufacturing for the future:

- by using software to virtually develop and test products prior to manufacture, possible errors are avoided and functionality is improved – 42.75% of total answers
- humans and machines are more productive today if digitisation is used in their processes – 53.75% of total answers

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

Focus on ICT

The importance of digital technologies in Furniture and Woodworking Industries



Graphic 14: The Importance of Digital Technologies in Furniture and Woodworking Industries.

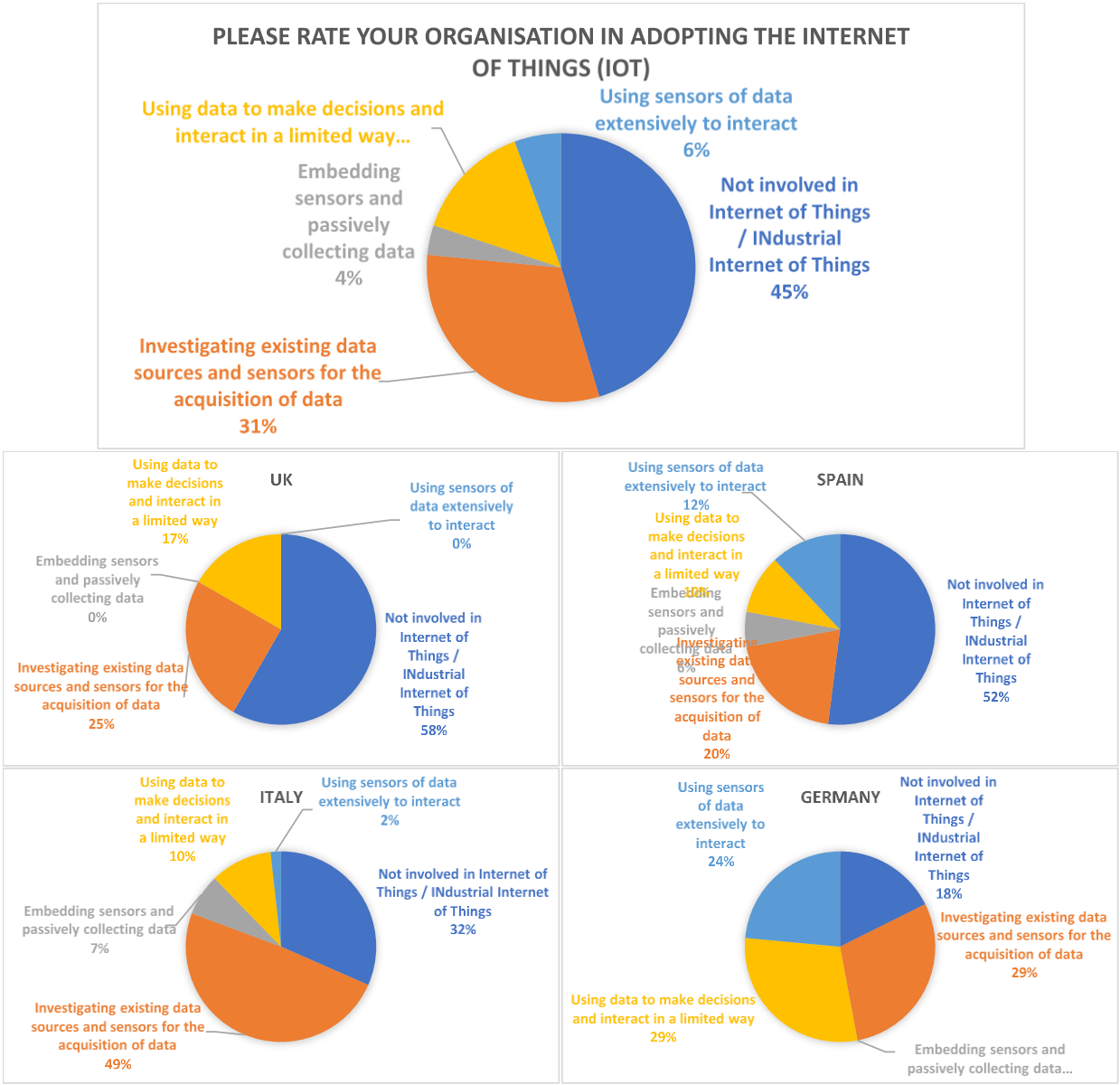
- 56% of UK companies have NO FORMAL DIGITAL BUSINESS STRATEGY, while 29% of them is assessing the potential of digital technologies for their business.
- 42% of ITALIAN companies are ASSESSING THE POTENTIAL OF DIGITAL TECHNOLOGIES, while almost 32% of them is INVESTING IN DIGITAL TECHNOLOGIES IN SPECIFIC BUSINESS UNITS
- 47% of SPANISH companies have NO FORMAL DIGITAL BUSINESS STRATEGY, while 25% of them are INTEGRATING DIGITAL TECHNOLOGIES IN THE BUSINESS STRATEGY

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

- 41% of GERMAN companies are INVESTING IN DIGITAL TECHNOLOGIES IN SPECIFIC BUSINESS UNITS and 29% of them are COMPREHENSIVELY INVESTING IN DIGITAL TECHNOLOGIES AS PART OF THE OVERALL BUSINESS STRATEGY

The level of integration and use of digital technologies in the sector is higher in Germany (still related to the size and organisation of responding companies); followed by Italy, UK and SPAIN respectively where more than 40% of respondents cited that they have no digital business strategy.

The adoption of Internet of Things in Furniture and Woodworking Industries



Graphic 15: The Adoption of IoT/IIoT in Furniture and Woodworking Industries.

- 58% of UK companies are NOT involved in IOT/IIOT at all; 25% are investigating existing data sources and sensors for the acquisition of data.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

- 32% of ITALIAN companies are NOT involved in IOT/IIOT at all, 42% are investigating existing data sources and sensors for the acquisition of data and 10% use data for decision making and interacting.
- 52% of SPANISH companies are NOT involved in IOT/IIOT at all, 20% are investigating existing data sources and sensors for the acquisition of data, 12% use data for decision making and interacting.
- Only 18% of GERMAN companies are NOT involved in IOT/IIOT at all; 29% of them are investigating existing data sources and sensors for the acquisition of data; 29% are using data for decision making and interacting in a limited way and 23% are using sensors or data extensively to interact.

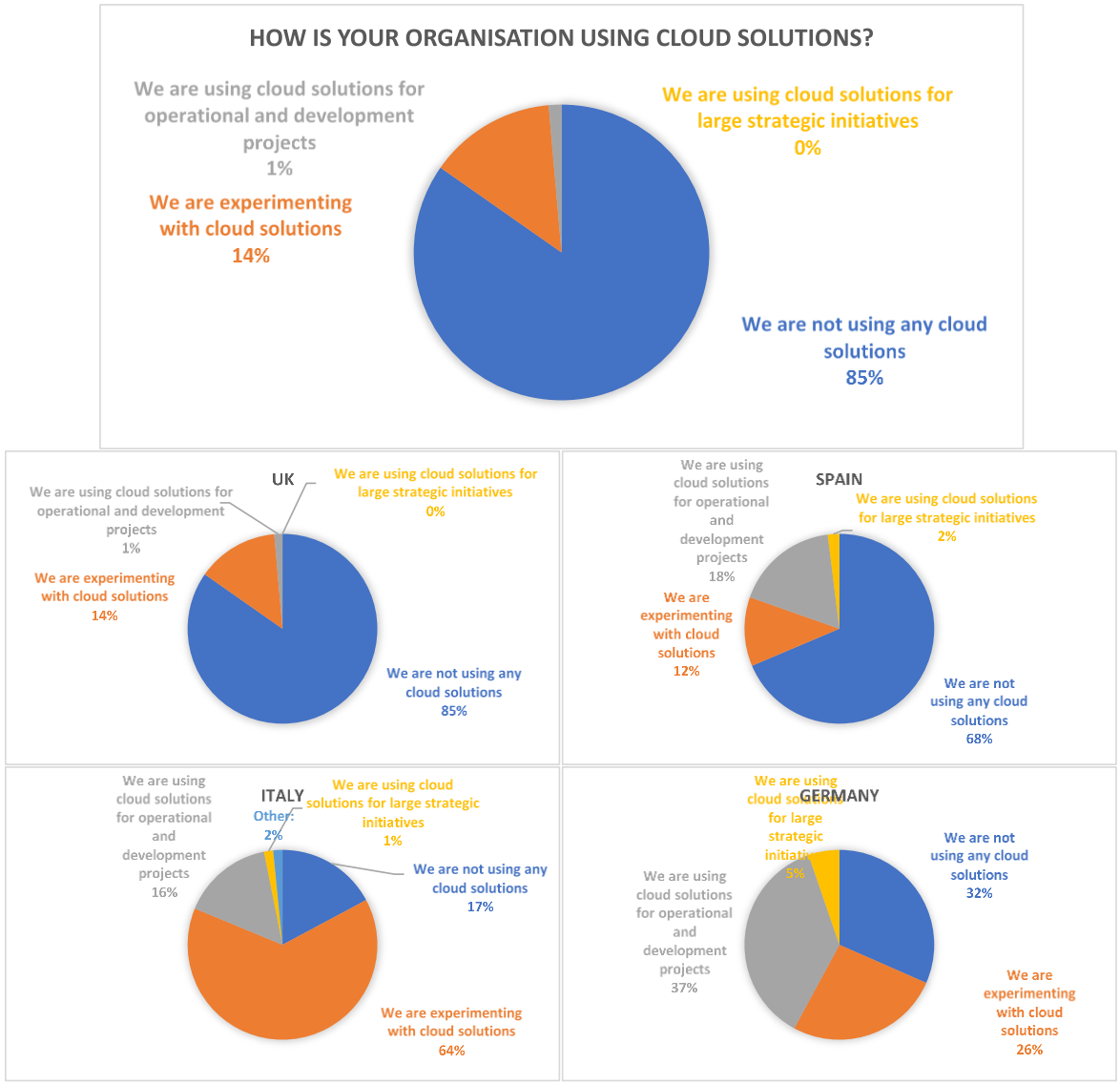
The stated level of integration and use of IoT and IIOT technologies gives a very differentiated output depending on the country and the target of addressed companies: while most of Spanish, Italian and English manufacturers are not involved in IoT and IIoT at all, most of Germans are dealing with data sources and sensors in multiple ways and only 17% of them declare they aren't involved in IoT/IIoT.

53% of German companies are using sensors and data extensively to interact and using data for making decisions, whereas only 12% of Italian, 22% of Spanish and 17% of UK companies are doing the same.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

Focus on CLOUD SOLUTIONS:

Cloud Solutions at the Furniture and Woodworking Industries



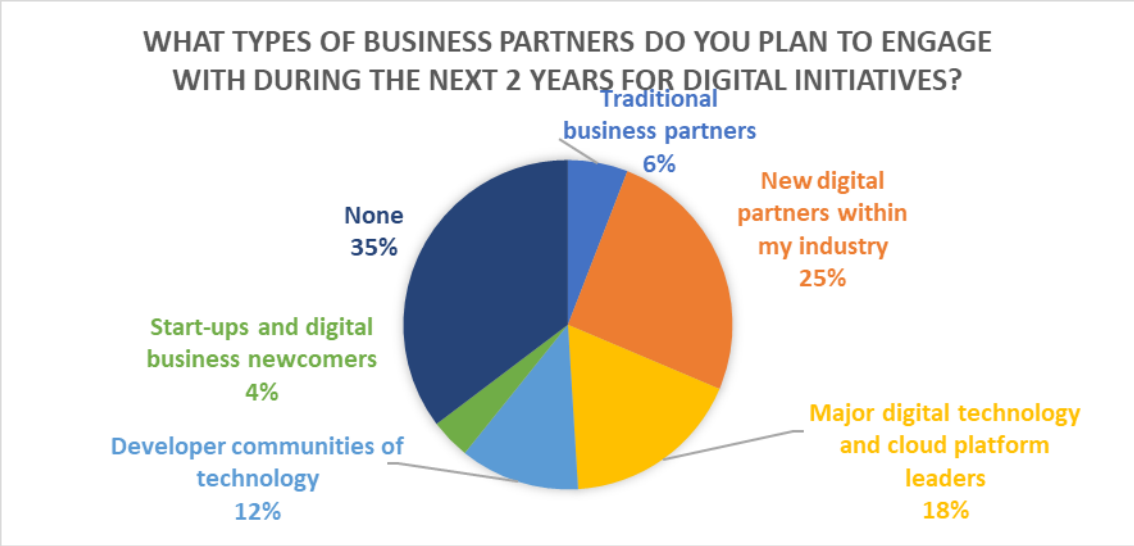
Graphic 16: Cloud Solutions at the Furniture and Woodworking Industries.

- 85% of UK companies are NOT using any cloud solutions
- 17% of ITALIAN companies are NOT using any cloud solutions, 64% are EXPERIMENTING with some cloud solutions
- 68% of SPANISH companies are NOT using any cloud solutions, 12% are EXPERIMENTING with some cloud solutions
- 32% of GERMAN companies are NOT using any cloud solutions, 26% are EXPERIMENTING with some cloud solutions and 37% are using cloud solutions for development of projects.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

In order to apply digital technologies in the future most manufacturers state they would approach (in the next 2 years):

Future collaborations in the Furniture and Woodworking industries



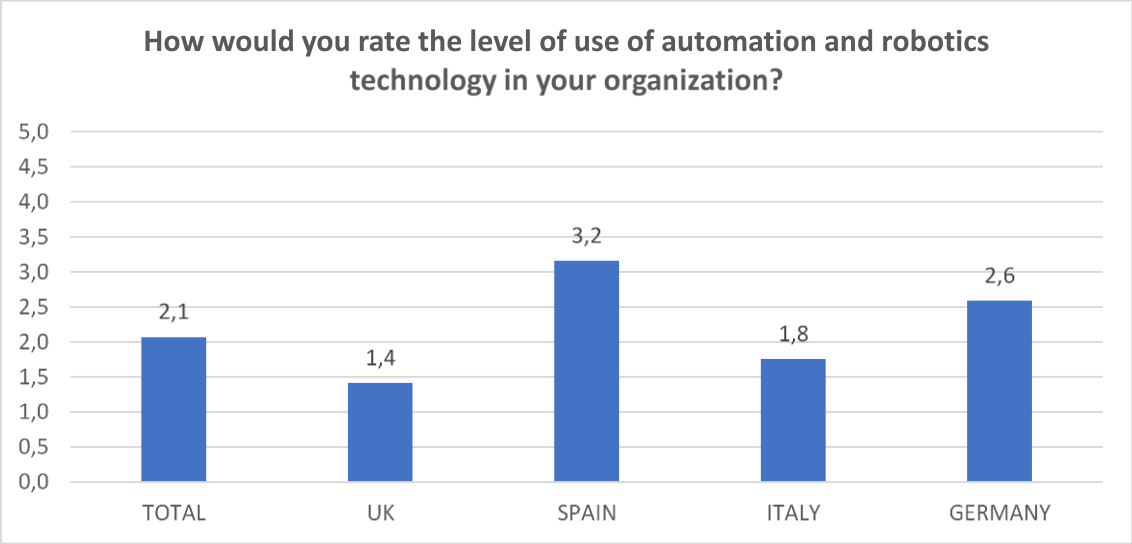
Graphic 17:Future Collaborations in the Furniture and Woodworking Industries.

Evidently for the adoption of new technologies, traditional partners do not seem to be the most reliable partners; while new digital partners and major digital technology and cloud platform leaders are those that will be selected in the future for this purpose by the majority of companies.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

Focus on ROBOTICS:

Level of automation and robotics technology in furniture industries



Graphic 18: Level of Use of Automation and Robotics in the Furniture and Woodworking Industries.

- 69% of UK companies rate themselves as VERY POOR in the use of robotic solutions within their companies, even if most of them know about possible applications in manufacturing, packaging, control areas.
  The use of robotic solutions is rated as very efficient especially in productivity, product quality and waste reduction.
  Actually in 85% of these companies in UK there is no relation between robotic solutions and other technological solutions.
  47% of responding managers state that the workforce in their company wouldn't be ready to accept a more automated workplace.

- 55% of ITALIAN companies rated themselves as VERY POOR in the use of robotic solutions within their companies, even if most of them know about possible applications in the production process and control of all business processes where robotic solutions can make those processes more efficient and easy to manage.
  The use of robotic solutions is rated as efficient in workers' safety, (40% medium level), productivity (40% medium level).
  Actually in 85% of these companies in ITALY there is no relation between robotic solutions and other technological solutions.
  57% of responding managers state that the workforce in their company wouldn't be ready at all or only a little in accepting a more automated workplace.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

- 43% of SPANISH companies rated themselves as GOOD regarding the level of use of robotic solutions in their companies and see the most interesting areas of application as being manufacturing, packaging and logistics.
  The use of robotic solutions is rated as very efficient especially in productivity, workers' safety, product quality.
  Actually in 69% of these companies in SPAIN there is no relation between robotic solutions and other technological solutions.
  48% of responding managers stated that their workforce would accept a more automated workplace at a medium level.

- 50% of GERMAN companies rated themselves as VERY POOR in the use of robotic solutions within their companies, even if most of them agree in possible applications in manufacturing.
  The use of robotic solutions is rated as very efficient especially in safety, product quality then productivity.
  Actually in 82% of these companies in GERMANY there is no relation between robotic solutions and other technological solutions.
  47% of answering managers state that the workforce in their company would accept a more automated workplace at a medium level.

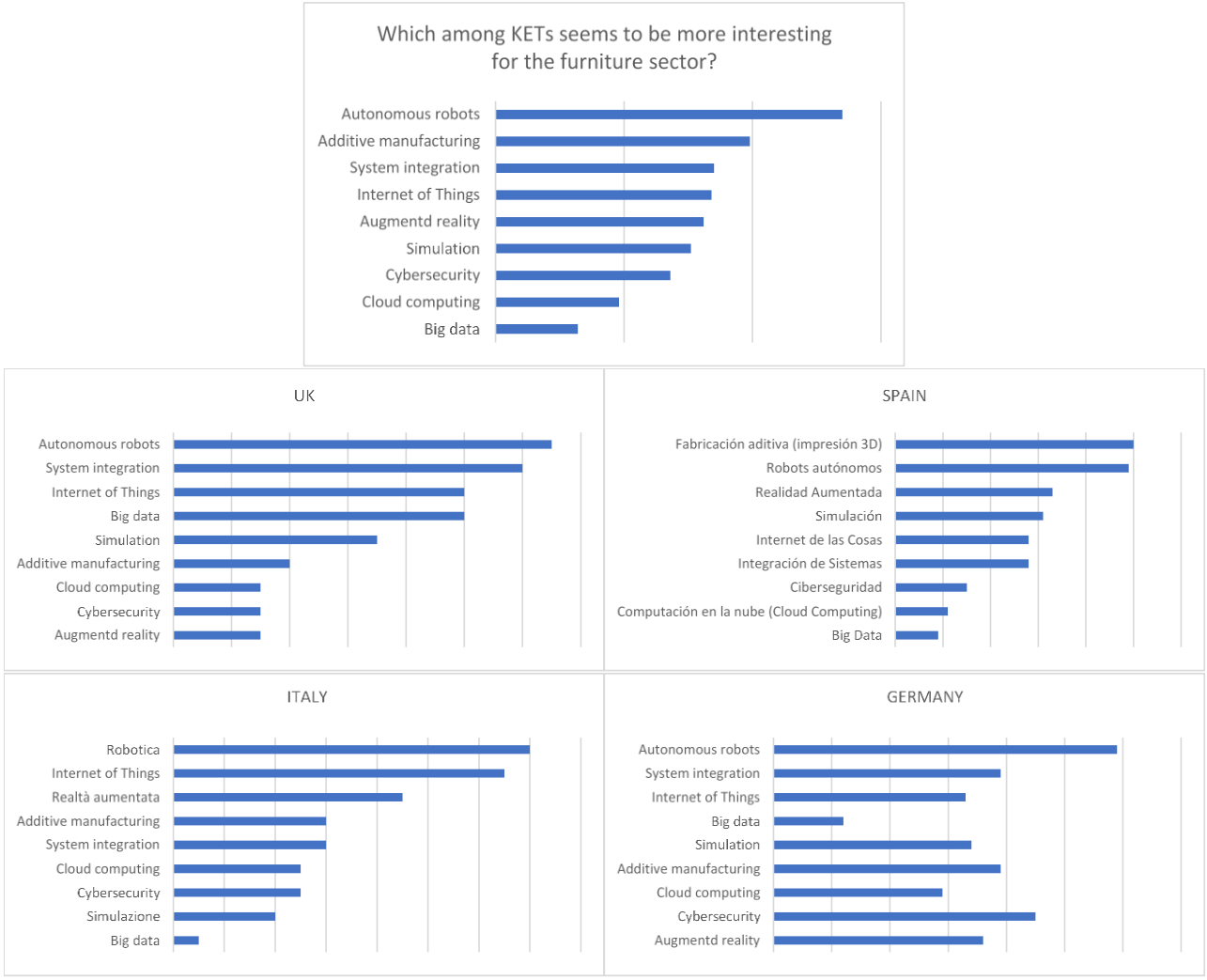
5.2 VET/HE communities

(ref. Annex 2)

Among VET/HE communities' respondents, an average of half of them have had previous experience in cooperating with companies (IT, robotics, energy, industry, tourism) but rarely in the furniture sector.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

The most interesting KETs for the furniture sector have been described as follows:



Graphic 19: More Interesting KETs for the Furniture and Woodworking Industries according to VET/HE Communities.

When entering in countries' specific cases, despite previous declarations:

- In UK, 72% of respondents declare they do not know how KETs would be applied in the sector; 77% have never applied KETs during their studies/activity or work. The remaining 23% have applied KETs in manufacturing processes and logistics.
  Lack of knowledge and difficulties in understanding the benefits deriving from the application of KETs compared to the initial cost seem to be the main barriers found during this kind of application.

- In Italy, 84% of respondents declare they do not know how KETs would be applied in the sector; 69% have applied KETs during their studies/activity or work but not in the

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

furniture sector (mainly in automotive, home automation, assisted living → sectors which are close to furniture manufacturing).
Lack of knowledge, hardware performance and difficulties in understanding the benefits deriving from the application of KETs compared to the initial cost seem to be the main barriers found during this kind of application.

- In Spain, 79% of respondents declare they do not know how KETs would be applied in the sector; 68% have never applied KETs during their studies/activity. The remaining 32% have applied KETs in prototyping and simulation processes mainly in IT, mass production sectors, automotive.
- Lack of knowledge, skills, powerful IT systems implemented in the companies, technological barriers like the need of standardisation seem to be the main barriers found during this kind of application.

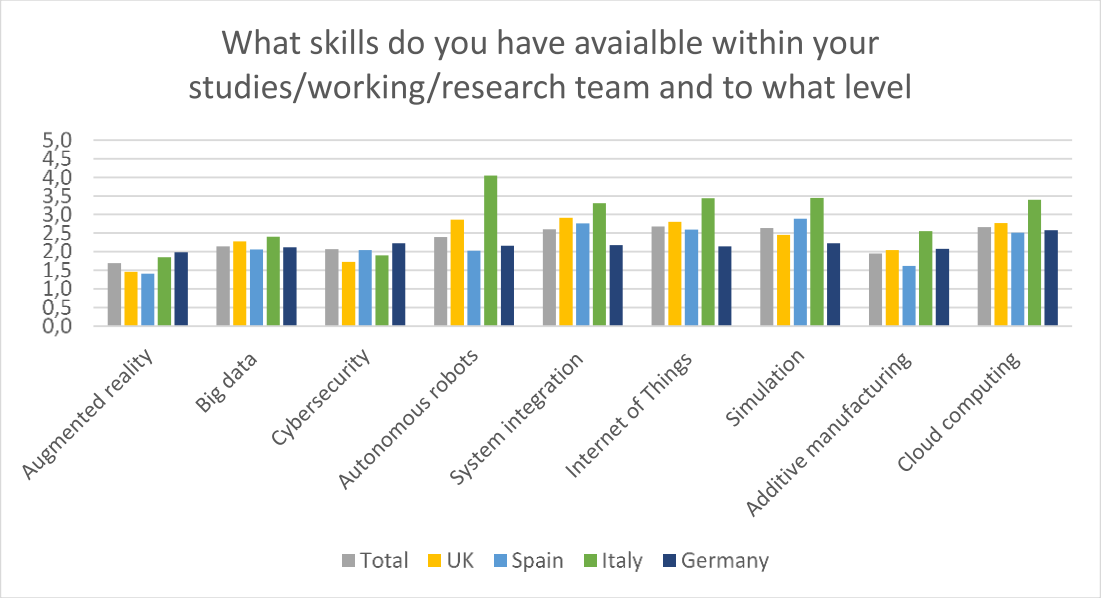
- In Germany, 91% of respondents declare they do not know how KETs would be applied in the sector; 80% of them have never applied KETs during their studies/activity or work. Those that have done (20%) have been focusing on IoT, Augmented reality, 3d printing, simulation especially in production and logistics, energy sectors.
  Workers' lack of knowledge and skills related to the application of KETs, difficulties in understanding the benefits deriving from the application of KETs compared to the initial cost seem to be the main barriers found during this kind of application.

In the VET/HE communities among partner countries the existing skills available that can be considered in case of definition of training paths aiming at crossing knowledge between the world of research, education, professional training and the world of furniture production, are described as follows:

Skills on KETs within HE/VET programmes

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union



Graphic 20: Existing Skills within HE/VET programmes.

UK

SKILLS	LEVEL
Augmented reality	Almost 85% low
Big data	60% low
Cyber Security	72% low
Autonomous robots	**Almost 50% high level**
System integration	**45% high level**
IoT	44% high level, 49% low
Simulation	Almost 50% low
Additive manufacturing	55% low, 30% medium
Cloud computing	**65% medium to high level**

ITALY

SKILLS	LEVEL
Augmented reality	Almost 76% low
Big data	45% low, 30% medium
Cyber Security	76% low
Autonomous robots	**Almost 76% high level**
System integration	**67% high level**
IoT	**76% high level**
Simulation	**Almost 83% high level**
Additive manufacturing	45% low, 23% medium
Cloud computing	**83% medium to high level**

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

SPAIN

SKILLS	LEVEL
Augmented reality	Almost 86% low
Big data	93% low
Cyber Security	86% low
Autonomous robots	Almost 89% low level
System integration	**60% medium to high level**
IoT	**60% medium to high level**
Simulation	**Almost 68% medium to high level**
Additive manufacturing	82% low level
Cloud computing	48% low level, 43% medium

GERMANY

SKILLS	LEVEL
Augmented reality	Almost 83% low
Big data	71% low
Cyber Security	58% low, 28% medium
Autonomous robots	Almost 88% low level
System integration	65% low level
IoT	56% low level, 49% medium level
Simulation	**63% low, 33% medium to high**
Additive manufacturing	Almost 90% low
Cloud computing	**53% medium to high level**

In a general view, skills related to SYSTEM INTEGRATION, IOT, AUTONOMOUS ROBOTS, CLOUD COMPUTING AND SIMULATION are present in the VET/HE communities involved at a medium to high level of competence; while BIG DATA, CYBER SECURITY, AUGMENTED REALITY are there at a low level and ADDITIVE MANUFACTURING at a medium level.

When discussing training topics and methodologies for the furniture manufacturing sector in relation to Industry 4.0 KETs, VET/HE communities were asked which topic should be considered as lacking skills within the sector. Most relevant answers were related to:

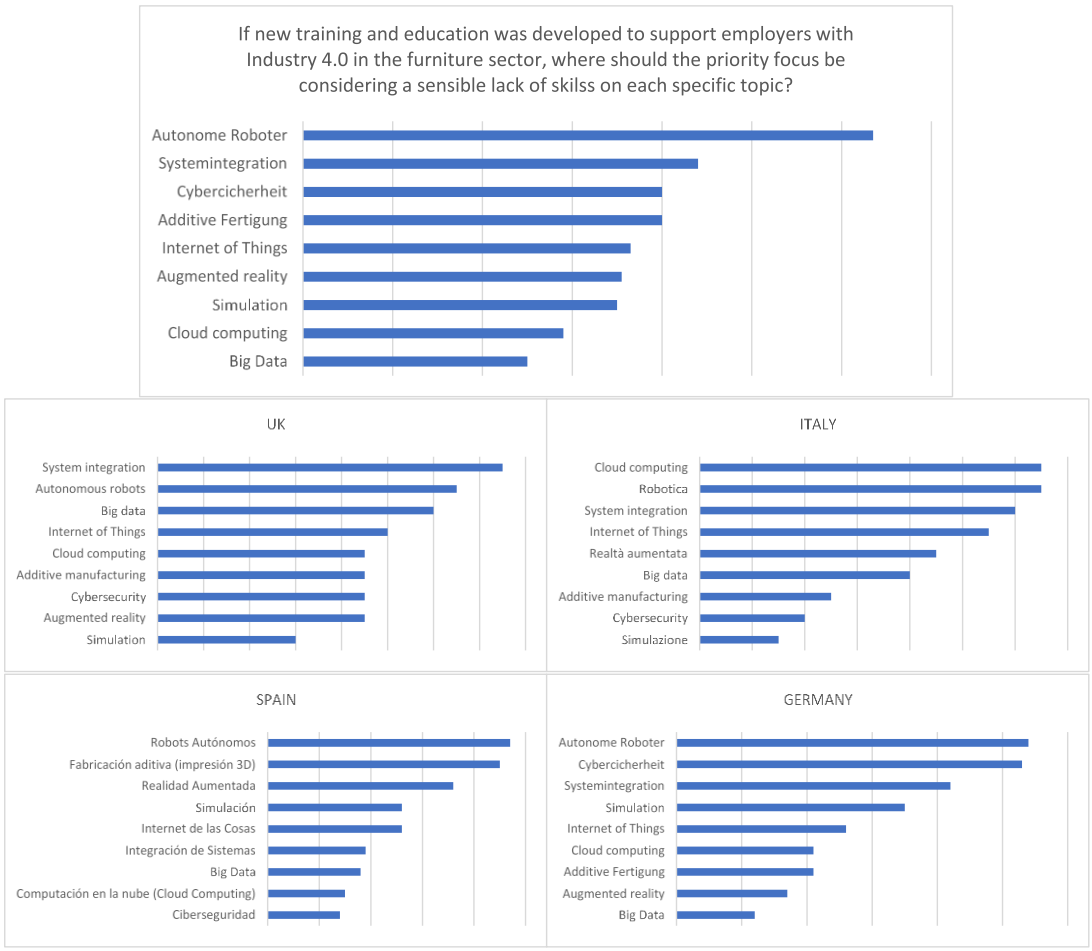
This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

Priorities in KET training within the furniture industry

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union



Graphic 21: Priorities in Training for the Furniture Industry according to VET/HE communities.

- **UK:** SYSTEM INTEGRATION, AUTONOMOUS ROBOTS, BIG DATA, IOT
- **ITALY**: CLOUD COMPUTING, SYSTEM INTEGRATION, IOT AND AUTONOMOUS ROBOTS
- **SPAIN**: AUTONOMOUS ROBOTS, ADDITIVE MANUFACTURING, AUGMENTED REALITY
- **GERMANY**: CYBER SECURITY, AUTONOMOUS ROBOTS, SYSTEM INTEGRATION

Blended learning is considered as the most suitable type of training in UK, Italy, Spain, while in Germany the better method seems to be online training.

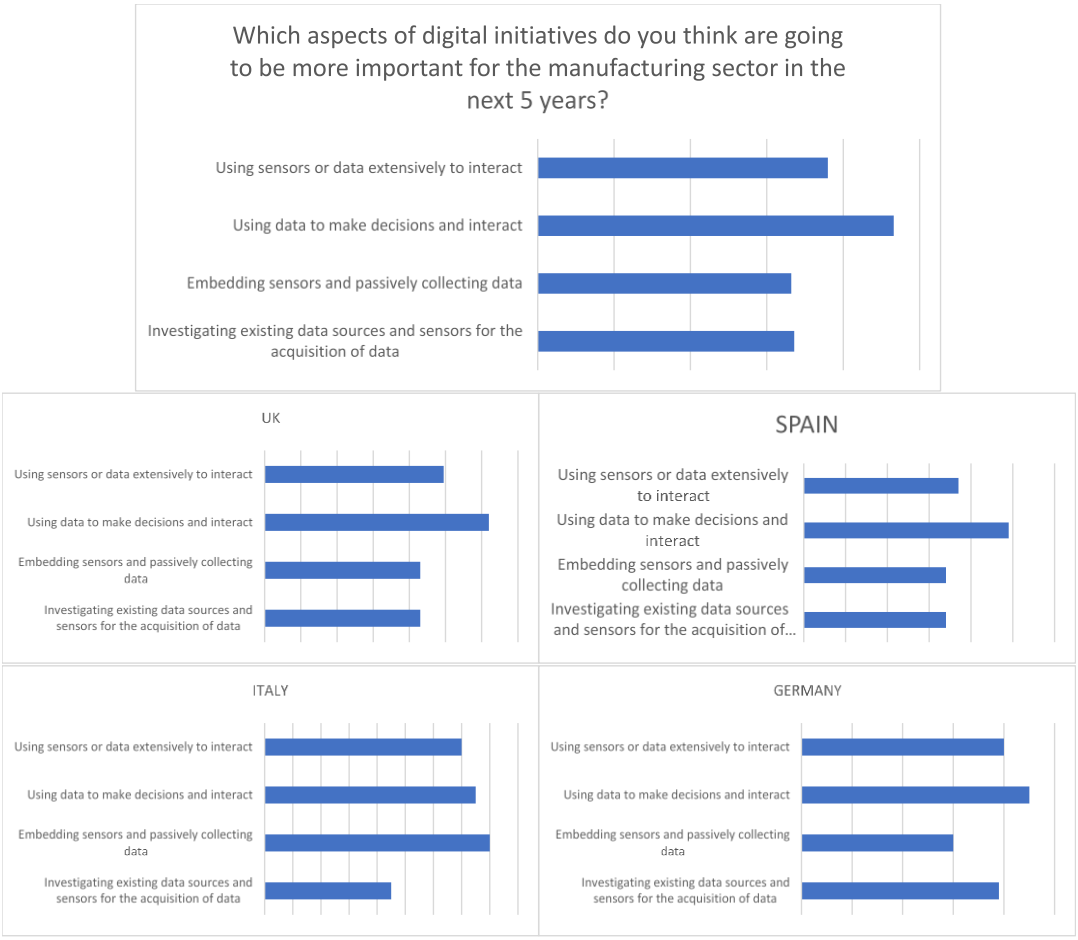
75% to 90% of respondents from VET/HE communities in all countries have stated that they have never, in their research or working activity, entered in contact with research centres that are specialised in KETs/I4.0. Those few that have had such experiences have been in contact with local and national centres.

Despite this, in the future, 86% in UK, 92% in Italy, 86% in Spain and 80% in Germany think that the application of KETs is an opportunity in terms of competitiveness for business and new jobs.

Rating 1 to 5, 95% state that digital technologies are important 4 or 5 (high level) for their future job.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

The importance of digital initiatives in the manufacturing sector for the next future



Graphic 22: The Importance of Digital Technologies in the Furniture and Woodworking Industries.

In all countries it is clear that **in the next 5 years IoT and IIoT are becoming strategically important** especially for:

- UK: 53% → using data to make decisions and interact.
- IT: 32% → inclusion of sensors for data collection and 28% → using data to make decisions and interact.
- ES and DE: 30% → using data to make decisions and interact, 20/22% → use of sensors for interaction and use of existing data sources, using sensors to extensively interact.

Those that are actually applying KETs technologies in their activity have mentioned the following results both at innovation and research level:

- UK: most of them have not yet evaluated the results as the projects are still underway.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

- ITALY: acquired the ability of integrating KETs in processes, efficiency is the major result seen at innovation level; at the research level the implementation of technologies.

- SPAIN: at innovation level, despite the many answers stating that no specific results have yet been achieved, those answering specifically state the possibility of making the product more attractive for the final client, traceability of products, higher performances in design and product engineering, reduction of costs and automatisation of processes, productivity. At research level, development of some technologies, better knowledge on technologies themselves, despite the many answers stating that results have not been verified.

- GERMANY: at innovation level most of respondents state they have not verified specific results, those answering positively mention the use of 3D printing which makes the prototyping phase much easier and cost effective.

Sectors of Application

Most of sectors seem to be areas of application of some of the listed KETs: industrial sector, public administration, Logistics, management of processes in general, home automation, automotive, smart cities and smart environments, energy sector, IT.

In relation to the furniture sector the application of information technologies to the production process can bring the following advantages:

- Higher productivity of humans and machines thanks to their interaction (UK 50%, IT 33%, ES 42%, DE 45%).
- Reduction of errors and costs in prototyping before production thanks to virtual technologies (UK 38%, IT 66%, ES 57%, DE 54%)

Focus on ROBOTICS:

The areas where the application of robotic solutions brings about major results are: manufacturing, packaging, cleaning, logistics, control.

Robotic solutions' application brings efficiency especially in:

	United Kingdom	Italy	Spain	Germany
Productivity	55% Rate	61% Rate 5	50% Rate 5	39% Rate 4
Product Quality	38% Rate 5	55% rate 5	47% Rate 4	35% Rate 4
Waste Reduction	33% Rate 5	66% Rate 5	46% Rate 4	48% Rate 3
Safety and Security for workers	38% Rate 5	44% Rate 4	42% Rate 4	42% Rate 4

Table 1: The efficiency that Robotics Solutions brings to different Processes.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

According to respondents, robotic solutions can make their future work smarter, support problem solving, make the decision process more precise, accurate, simplify all processes including decision making and analysis process.

All respondents stated they would be available for an online or blended course of at least **30-60 hours** spread over a number of smaller sessions.

5.3 KETs experts

(ref. Annex 3)

KETs' experts having answered the questionnaire, have pointed out the following situation:

- Most of them have not yet been involved in professional training programess for companies / manufacturers in relation to KETs (83% in UK, 100% in Italy, 100% in Germany, 85% in Spain) meaning that the close relation between Industry 4.0 competences (knowledge coming from research organisations and specialised professionals) and the production world with a specific focus to the furniture manufacturing sector has not yet been built into the national or regional context. Other sectors, which are much more technology-oriented have already been approached by specific professional training programmes for the enhancement of competences and skills related to KETs in Industry 4.0.

- Those, a few in UK and Spain, who have already been involved in this kind of training programme focusing on Industry 4.0 KETs topics specify that the main barriers found during the implementation of said technologies are: lack of skills and knowledge among staff, understanding of initial cost of technology versus the long-term effect on the business, poor basic training level, resistance to change.
  It is clear that in the furniture manufacturing sector, the need of KETs related knowledge seems to be high as most of KETs' experts answered mainly poor the knowledge level of manufacturers in this field.

- The areas of application of KETs in which furniture manufacturers should be more interested and should get more benefit for their activity are generally ALL in the business process, for instance:
  - (UK) IoT for furniture life cycle management or augmented reality for enhancing the manufacturing process, delivery to customers' stage.
  - (IT) marketing, market analysis and relation with clients by the use of IoT and augmented reality, additive manufacturing and simulation.
  - (DE) sales and maintenance (use of augmented reality and IoT).

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

- (ES) production management, logistics, delivery, automatization of some processes in case of mass production, prototyping and design, marketing and relationship with clients (also in terms of market analysis and feedback)

This kind of evaluation, also deriving from the knowledge of each country KETs experts, reflects the national specificity of the furniture sector: while in Germany the core of the sector involved is mainly done by medium or big sized companies with specific needs related to a mass production (technologies applied to the production process and also maintenance and sales levels); in Spain and UK the approach to Industry 4.0 KETs is more related to the manufacturing process including logistics and delivery; in Italy, where the production process in the whole business of the furniture manufacturing sector counts a small % (most of companies are small in size and are concentrated on finishing instead of mass production) compared to the importance of other processes such as design, prototyping, sales, marketing, the application of KETs is seen much more in relation to the approach to the market, than automisation of processes.

5.4 Commercial solutions available on KETs for future application in the furniture sector

As a part of Task 1.6, the team aims to identify commercial products and solutions related to the KET that can be applied to the furniture and wood sector within a context related to Industry 4.0. To achieve this, we must look for the junction between the demands of furniture industry and the forefront technologies. An exhaustive document on this has been developed by the In4Wood alliance and added to the current deliverable as an annex 4.

Several European manufacturers in the field already use KETs and other advanced technologies to contribute to their activities. KET (Key Enabling Technologies) are the set of six technologies defined by the European Commission because of their excellent potential to improve economically and technologically the situation in Europe:

- **Nanotechnology:** A mostly unfeasible alternative until recently, it already has viable, safe and profitable applications for furniture industry including: Polymer reinforcement, coating and finishing with properties (anti -fungi, -bacterial, -spots, -pollution, -scratches, self-cleaning, self-repairing, etc.). Lotus Effect®, with dirt- and water-repellent properties, can be implemented in furniture covering; and TiO_2, that removes waste products under some conditions, can also apply.

- **Micro and nanoelectronics:** In industrial applications and in Europe, Germany is in the vanguard of this one, as demonstrated by several products of ELMA GmbH such as X-tra and STC, both for automated robot lines. There are also hygienic lines with specific agents and multi-frequency system for industrial fine cleaning.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

Semiconductors are a specific case in this technology. They are used in circuitry for memory chips, commodity integrated circuits, microprocessors and SOC (System On a Chip). The last one is a growing demand, and the one before it have unexploited niches -the two first ones have a stable market with little to capitalize from at the moment.

- **Photonics:** Defined as the application of light (either visible or not) for processes going from industrial lasers to TIC. VLC and IRC (visual and infrared, respectively) are trending in the last sense. Industries making the most of photonics include medical, aerospace, automotive, energy, fluid management and fibre optics, partly because they demand specific isolations against abrasion, chemicals and extreme temperatures. Photonics21 is a European community for industrial and R&D stakeholders; South Africa also has active communities.

- **Advanced Materials:** Graphene is a 1-atom-thick material with fascinating properties. It can provide heat (or dissipate heat, depending on the circumstances), resist scratches or monitor health signs, among some uses that make the most sense in furniture industry. Within this domain, it will be very useful in less-than-mild environments, like sierra habitats.

- **Industrial Biotechnology:** This refers to replacing materials, like the petroleum-based foam used in furniture for too long, with other items that are renewable, less demanding in energy and providing the same performance, like, following the same example, Cargill's BiOH® (soy-based polymers) and Dow's RENUVA (oil- and bio-based polyol without unwanted odour). Both have succeeded in implementing these technologies to bed manufacture and other furniture and products like carpets and seats; bedding in particular is relevant because mattresses have stricter needs related to weight.

- **Advanced Manufacturing Systems:** Europe is clearly motivated in the integration of this KET, as seen for instance in the yearly Composites and Advanced Materials Expo (Anaheim) and in the fact that several Spanish furniture companies have already incorporated 3D printing, advanced robotic and RFID in their processes. RFID (Radio Frequency Identification) is a technology providing clarity to the whole industrial process to track components and orders, streamlining throughputs and keeping faults, rejects and complaints to a minimum. At the same time a very useful and resilient technology, it is being expanded to many fields.

Figure 1: RFID solutions for wood and furniture

As said, Germany is a European powerhouse in several of these, including micro and nanoelectronics, photonics and industrial biotechnology.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

There are several other aspects that also deserve study in the document as they are related to the implementation of the KETs. Some of these are:

- **Cloud Computing:** The delivery of IT services through a network (typically Internet), allowing for the distributed offering of software, infrastructure, platforms, etc.
- **Cyber Security:** Physical and logical protection of the technology, with minimal impact in the production. Expertise on the area is becoming more extended. Within that field, ransomware is a relatively recent threat, having boomed since 2005 – previously the combination of software, sabotage and extortion was rare, even more in industrial systems.

Our study ends with detailed examples of Industry 4.0 in furniture. Many innovative products and services are provided to the furniture domain by companies like: Bigrep (3D printing), Daqri (sensoring wearables), HOMAG (network productions), Microtec (wood scanning and sorting optimization), Pepperl+Fuchs (electrical explosion and sensoring) and ViewAR (augmented and virtual reality). Each is described with documented examples.

Similarly in robotics, also for the wood and furniture system, we have: 6 River systems (mobile platforms), ABB (robotics for complete application solutions), Automatech Robotik (cutting, sanding, palletizing, etc.), EiraTech robotics (mobile platforms), Epistolio (paiting robots), Fanuc (assembly, machine tending, material removal, etc.), Kuka (handling and palletizing, mobile platforms), Metralabs (mobile platforms), Schmalz (palletizing, gripping), Vacuum Gripper (clampers) and Yaskawa (lifting).

Figure 2: ABB robots handling furniture panels for Svedplan.

Figure 3: Networked production.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

6. Data results: panorama of learning outcomes per country with reference to NQF

This analysis has been carried out thanks to the interviews addressed to KETs experts, furniture manufacturers, VET/HE communities with specific reference to the knowledge and use of KETs of Industry 4.0 in the furniture manufacturing sector brings out the following main results.

Results have been described in detail as most of the answers are not general, but enter deeply into evaluations related to NEED OF TECHNOLOGY, EXISTING KNOW-HOW, COMPETITIVENESS RELATED TO THE USE OF KETS, TRAINING FORMULAs REQUESTED, TRAINING TOPICS and so on.

But main FLAGSHIP results can be described with the following charts highlighting the point of view of furniture manufacturers (managers of companies):

Existing Competences

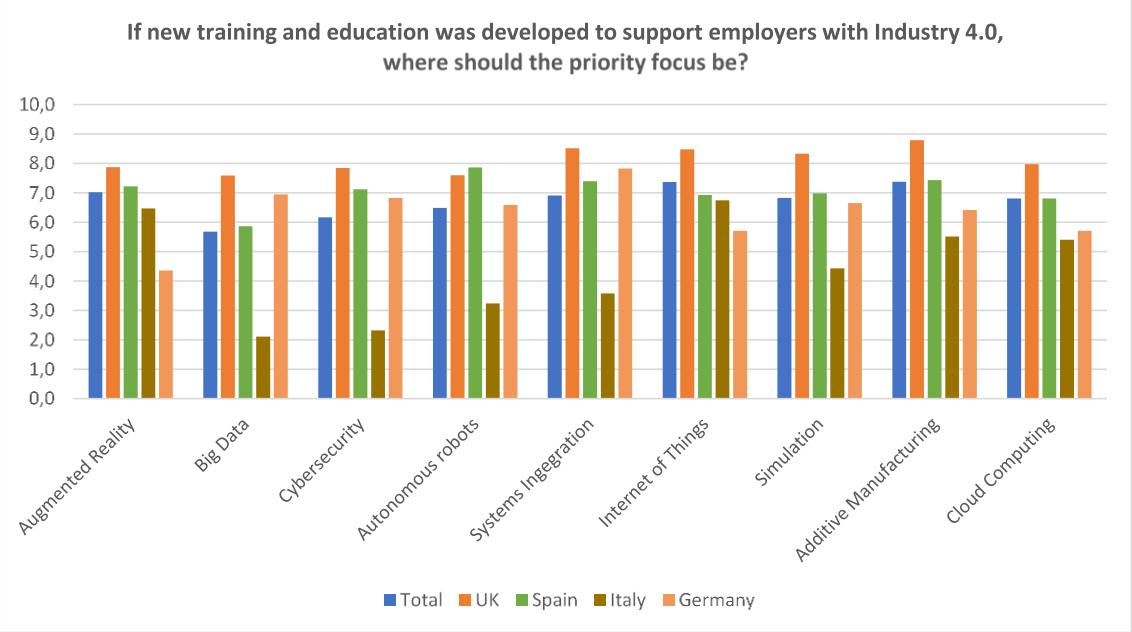
Workers' skills

Graphic 11: Workers´ skills.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

Needed, Requested Competences

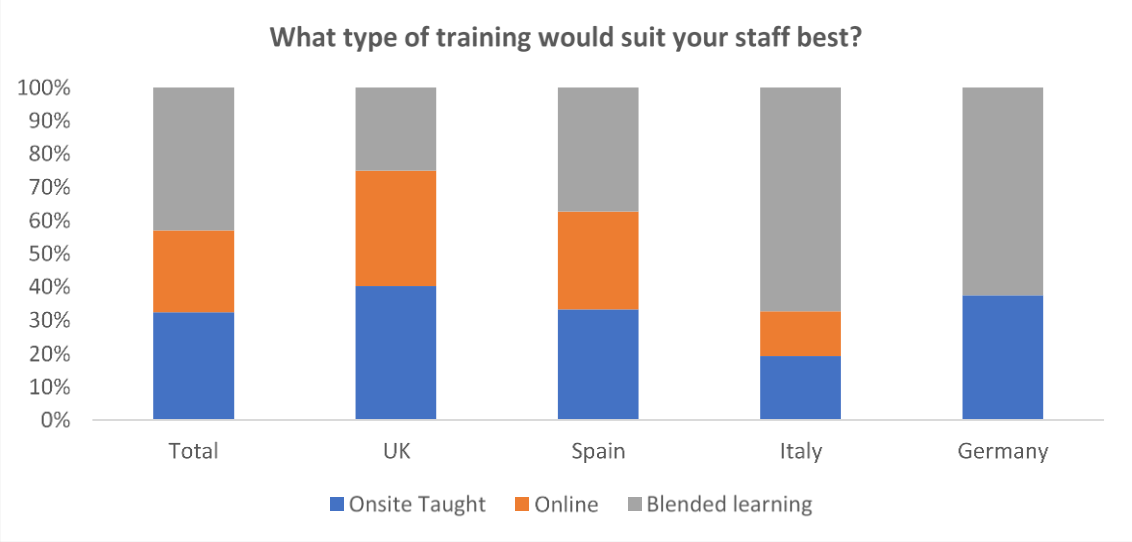
Priorities in training and education about I4.0 to support employers



Graphic 12:Priorities in training and education about I4.0 to support employers

Requested Training Formula

Training types preferences



Graphic 23: Training Types Preferences.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

European Qualifications Framework (EQF)

The **European Qualifications Framework** (**EQF**) acts as a translation device to make national qualifications more readable across Europe, promoting workers' and learners' mobility between countries and facilitating their lifelong learning. The EQF aims to relate different countries' national qualifications systems to a common European reference framework. Individuals and employers will be able to use the EQF to better understand and compare the qualifications levels of different countries and different education and training systems. Since 2012, all new qualifications issued in Europe carry a reference to an appropriate EQF level.

The core of the EQF concerns eight reference levels describing what a learner knows, understands and is able to do – 'learning outcomes'. Levels of national qualifications will be placed at one of the central reference levels, ranging from basic (Level 1) to advanced (Level 8). This will enable a much easier comparison between national qualifications and should also mean that people do not have to repeat their learning if they move to another country.

Level of qualification	Knowledge	skills
Level 1	Basic general knowledge	Basic skills
Level 2	Basic factual knowledge	Basic cognitive and practical skills
Level 3	Knowledge of facts, principles, processes and general concepts	Range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information
Level 4	Factual and theoretical knowledge in broad contexts	Range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study
Level 5	Comprehensive, specialized, factual and theoretical knowledge within a field of work or study and an awareness of boundaries of that knowledge	A comprehensive range of cognitive and practical skills required to develop creative solutions to abstract problems
Level 6	Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles	Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in specialized field of work or study
Level 7	Highly specialized knowledge; critical awareness of knowledge issues in a field	Specialized problem-solving skills
Level 8	Knowledge at the most advanced frontier of a field of work or study	The most advanced and specialized skills and techniques, including synthesis and evaluation.

Table 2: Levels of the European Qualification Framework.

Then, the National Qualification Frameworks (NQF) in each country of the In4Wood alliance (Spain, Italy, UK, Germany) have been verified in their most updated versions (annexes 4-7) in order to

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

identify the correspondence between EQF and national qualifications with specific attention to **professional education levels**. This is connected with the following point 6 of this document aiming at implementing the harmonization of results (lacking competences and skills) with National Qualification Profiles related to the furniture industry.

In the Italian case, the National Qualification levels are directly connected to the European ones and takes into account VET/professional training from **Level 2 up to Level 4 and Level 5 (higher technical Institutes) even if no profiles have been selected in Level 2.**

EQF	NQF (Italy)	Qualifications
Level 1	Level 1	lower secondary school leaving diploma
Level 2	Level 2	compulsory education certificate
Level 3	Level 3	professional operator certificate
Level 4	Level 4	professional technician diploma, upper secondary education diploma (including vocational schools)
Level 5	Level 5	higher technical education diploma
Level 6	Level 6	Bachelor degree
Level 7	Level 7	Master
Level 8	Level 8	Doctor

Table 3: National Qualification Framework in Italy

In the Spanish case the equivalence between CNCP (National Catalogue of Professional Qualifications) and EQF is as follows **and levels from 1 to 3 for VET/professional training are taken into account:**

EQF	CNCP	Acreditación
Nivel 1	Nivel 1	Operario
Nivel 2		
Nivel 3	Nivel 2	Técnico Medio
Nivel 4		
Nivel 5	Nivel 3	Técnico Superior
Nivel 6	Nivel 4	Grado
Nivel 7	Nivel 5	Máster
Nivel 8	Sin definir	Doctor

Table 4: National Qualification Framework in Spain.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

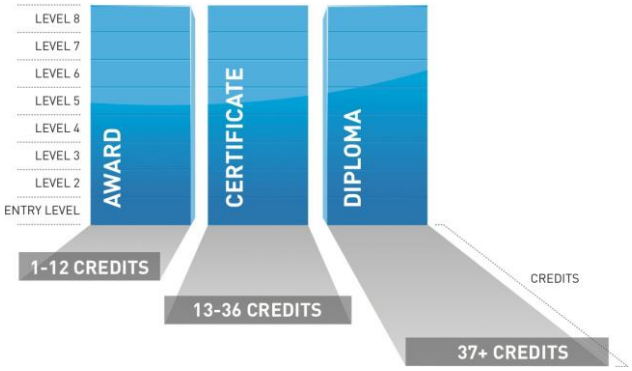
Funded by the Erasmus+ Programme of the European Union

The in case of the United Kingdom, the English and Welsh National Qualification levels are directly connected to the European ones and takes into account VET/professional training from **Level 2 up to Level 4 and Level 5, where as level 6 to 8 has generally been for Higher Education.**

EQF	NQF (UK)	Qualifications
Level 1	Level 1	Entry level certificates [Basic skills]
Level 2	Level 2	Traineeships, GCSE grades D to F, NVQ level 2
Level 3	Level 3	Apprenticeship, BTEC First Diploma, NVQ Level 3, GCSE grades A to C
Level 4	Level 4	Advanced Apprenticeship, Vocational A Level, AS/A2 level, NVQ level 4, Certificate in Higher Education
Level 5	Level 5	Higher Apprenticeship, HNC, Foundation Degree, Diploma in Higher Education, NVQ level 5
Level 6	Level 6	Higher Apprenticeship, Bachelor degree
Level 7	Level 7	Masters Degree, postgraduate certificates and diplomas
Level 8	Level 8	Doctorates

Table 5: English and Welsh National Qualification Frameworks.

Additionally, with the UK qualification system, learners can progress horizontally on a qualification level. The vertical climb indicates the increasing complexity of the subject matter, the horizontal is based on the increasing number of guided learning hours for the subject.



UK Qualification Credit Framework (QCF) part of the NQF

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

The UK, because it is made up of three countries, there are three frameworks which are aligned to the EQF. Scotland has 12 levels which map into the 8 levels offered in England, Wales and the EU with the exception of the SCQF levels 1 and 2 – these do not map to the EQF.

European Qualifications Framework (EQF)	Qualifications and Credit Framework England/ Northern Ireland (QCF)	Credit and Qualifications Framework for Wales (CQFW)	Scottish Credit and Qualifications Framework (SCQF)
8	8	8	12
7	7	7	11
6	6	6	10/9
5	5/4	5/4	8/7
4	3	3	6
3	2	2	5
2	1	1	4
1	E3	E3	3
	E2	E2	2
	E1	E1	1

Table 6: UK nations NQF comparison to EQF.

More recent developments in the UK have given rise to DEGREE apprenticeships allowing students and workers to achieve up to level 8 within the workplace, via vocational training routes. Some of these are delivered in partnership with universities, some through university/college partnerships.

In the German case the German national qualifications framework (DQR) is the instrument for the alignment of qualifications in the German educational system. DQR defines eight levels which can be aligned to the eight levels of the European Qualifications Framework (EQF). The equivalence between DQR and EQF is as follows **and levels 3 and 4 for VET/professional training are taken into account:**

EQF	DQR (Germany)	Qualifications
Level 1	Level 1	Vocational training preparation
Level 2	Level 2	Vocational training preparation, full time vocational school
Level 3	Level 3	DUAL VET (2 years)
Level 4	Level 4	DUAL VET (3 years)
Level 5	Level 5	IT specialist
Level 6	Level 6	Bachelor degree
Level 7	Level 7	Master
Level 8	Level 8	Doctor

Table 7: National Qualification Framework in Germany.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

7. Harmonisation of results with National Qualification profiles and ESCO competences

Results deriving from the analysis carried out lead the In4wood partnership to defining possible integration with existing national Qualification profiles with the lacking skills and competences in the furniture industry.

Here down follows the situation verified in each country:

Spain

The furniture and woodworking sector in Spain: Macroeconomic data

This industry, according to data from the National Institute of Statistics (INE) of 2005, is made up of a total of 35,890 companies. The atomization of the sector in small and medium enterprises is evident: 12,446 companies operate without employees (only the self-employed), while 11,074 employ less than two workers. The scheme is completed with 5,406 companies of between 3 and 5 employees, and another 2,738 between 6 and 10 employees. In summary, the fragmentation of the sector is demonstrated by the fact that 90.2% of companies have less than 20 employees. It is in the carpentry where there is a greater number of small companies, reaching 11,475.

The number of people employed in this industry - including basketry - was 118,500 in 2003 and 133,600 in 2004, according to the Active Population Survey. This sector brings together 14% of industrial companies in Spain and generates, approximately, 8.7% of the total employment corresponding to the industry.

The sector is evolving due to technological changes related to microelectronics:

- Numerical control machinery.
- Sophisticated design and tool development systems (with complex software).
- Robotics.
- Sensor technology.
- Automation of warehouses.

These developments must be reflected in their related professional qualifications.

Professional Qualifications related to furniture and woodworking industries.

According to sources from the General Sub directorate of Statistics of the Ministry of Education and Science, 115 VET centers provide cycles related to this family. During 2004, 85 cycles of medium grade and 23 of higher degree were taught in Spain in Wood, Furniture and Cork. The total number of students enrolled in 2005 was 3,192 in medium degree and 487 in higher degree. In VET, the number of courses completed in 2004 was 176 and the number of unemployed who participated in

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

them was 1,720. The number of students trained in Schools-Workshop was 1,734 in 2003 and 1,676 in 2004.

In Spain, the National Institute of Qualifications in Spain (INCUAL) manages the national catalogue of professional qualifications (CNCP), being a professional qualification a set of professional competences significant in employment which can be acquired through VET modules or any other kind of learning structure as well as through work experience.

A person is qualified when he/she achieves the expected outcomes during his/her professional performance, with reasonable resources and quality levels. The professional qualifications do not involve any regulation of professional practice.

A person's competence comprises the whole range of knowledge and capacities that enable to perform a professional activity according to productive system and employment demands.

The general competence of a professional qualification shortly describes essential tasks and functions of one professional worker.

The professional environment is described through both the field in which the tasks are developed, specifying the sort of organisations, areas and services as well as the productive sectors and the related occupations and positions. Every professional qualification has an alpha-numeric code.

The CNCP consists of professional qualifications arranged in professional families and levels of qualification taking into account UE criteria. The 26 professional families which make up the CNCP have been created according to professional competence affinity criteria.

The 5 levels of professional qualification are based on the professional competence required for each productive activity taking into account different criteria like knowledge, initiative, autonomy, responsibility and complexity, among others, necessary for the accomplishment of every activity.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

Level of qualification	Description
1	Competence in a reduced group of relatively simple working activities related to normalized processes, in which the theoretical knowledge and practical capacities involved are limited.
2	Competence in a group of well-defined professional activities with the capacity to use particular instruments and techniques concerning, mainly, an execution activity which can be autonomous within the limits of the above-mentioned techniques. It requires knowledge on the technical and scientific fundamentals of the activity concerned and capacities for the comprehension and the application of the process.
3	Competence in a group of professional activities which require the command of different techniques and can be executed in an autonomous way. It involves responsibility on the coordination and supervision of technical and specialized work. It demands the understanding of the technical and scientific fundamentals of the activities concerned as well as the assessment of the factors in the process and the assessment of the economic repercussions.
4	Competence in a wide group of complex professional activities performed in a great variety of contexts which require to combine technical, scientific, economic or organisational variables to plan actions, or to define or develop projects, processes, products or services.
5	Competence in a wide group of professional activities of great complexity performed in different contexts, often unpredictable, which imply to plan actions or to conceive products, processes or services. Great personal autonomy. Frequent responsibility on the assignment of resources and on the analysis, diagnosis, design, planning, execution and assessment.

Table 8: The five levels of professional qualification in the Spanish Qualification Framework.

Those professional qualifications related to Furniture and Woodworking fall within the family "Wood, Furniture and Cork", where 18 qualifications from levels 1, 2 and 3 can be found:

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

Reference	Qualification	Level	Hours	
MAM275_1	Application of varnishes and lacquers in carpentry and furniture elements.	1	210	RD 1136/2007
MAM212_1	Manufacture of cork objects.	1	240	RD 1228/2006
MAM057_1	Manufacture of cork stoppers.	1	400	RD 295/2004
MAM276_1	Carpentry and furniture Works	1	270	RD 1136/2007
MAM060_2	Carpentry and furniture finishing	2	490	RD 295/2004/ RD 1136/2007
MAM061_2	Wood sawing	2	400	RD 295/2004
MAM214_2	Manufacture of wood particle and fiberboards	2	300	RD 1228/2006
MAM277_2	Installation of carpentry elements	2	420	RD 1136/2007
MAM059_2	Furniture installation	2	550	RD 295/2004
MAM058_2	Wood and related Works	2	490	RD 295/2004/ RD 1136/2007
MAM062_2	Assembly of Furniture and Carpentry elements	2	450	RD 295/2004/ RD 1136/2007
MAM422_2	Assembly and installation of wooden constructions	2	420	RD 1958/2009 RD 1548/2011
MAM213_2	Obtaining veneer, plywood and veneered panels	2	300	RD 1228/2006
MAM215_2	Preparation of Wood	2	330	RD 1228/2006
MAM423_3	Organisation and production management in the furniture and carpentry industries	3	510	RD 1958/2009
MAM424_3	Manufacturing planning and management in wood and cork industries	3	570	RD 1958/2009
MAM063_3	Furniture and Carpentry projects	3	570	RD 295/2004
MAM425_3	Installation and furnishing projects	3	390	RD 1958/2009

Table 9: Spanish In4Wood related profiles.

Within this family, those Qualifications related to the In4Wood Target users are *MAM423_3 - Organización y gestión de la producción en industrias del mueble y de carpintería (Organisation and production management in the furniture and carpentry industries) and MAM424_3 Planificación y gestión de la fabricación en industrias de madera y corcho (Manufacturing planning and management in wood and cork industries). Both of them from level 3.* The details about both identified qualification can be seen in 7. Within both qualifications identified, Table 8 details the competence units and their associated training modules and skills/competences that may be subjected to review so as to address all needs identified within the In4Wood project.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

Qualification	General Competence	Competence units	Relevant occupations and workplaces.
MAM423_3 Organisation and production management in the furniture and carpentry industries	Organize, manage and supervise the production in furniture industries, scheduling and preparing the work to be performed according to the available resources, supervising the correct and timely execution of the work required for the manufacture of furniture with the required quality and safety measures, complying with current regulations and respecting the environment.	UC1361_3 - Planning and managing the warehouse and supplies in the furniture manufacturing industry. UC1364_3 - Participate in the maintenance of the systems of management of the quality, environment, prevention and occupational health in wood, cork and furniture UC1363_3 - Supervising and controlling production in furniture manufacturing industries UC1362_3 - Organize production in furniture manufacturing industries	Managers from Wood and cork industries. Managers from furniture manufacturing and related enterprises. Quality control technician in wood and cork industries
MAM424_3 Manufacturing planning and management in wood and cork industries.	Manage a manufacturing unit or section in the board, laminated wood and cork industries to reach the settled objectives fixed within production, quality and environment, preparing and supervising human and material resources.	UC1365_3 - Manage the park of wood and cork. UC1366_3 - Control the manufacturing processes in the wood saw industries UC1364_3 - Participate in the maintenance of the systems of management of the quality, environment, prevention and occupational health in wood, cork and furniture UC1368_3 - Control the manufacturing processes in the board and laminated glue industries. UC1367_3 - Control the manufacturing processes in the cork industry	Responsible for manufacturing of wood products and similar materials Head of manufacturing of cork products Responsible of treatments of wood and similar materials Responsible of cork treatments Quality control technician in industries of wood and similar materials Quality control technician in industries of cork Park and warehouse Management Technician in industries of wood and similar materials Production planning technician in industries of wood and similar materials Production control technician in industries of wood and similar materials Production control technician in cork industries Quality, Environment and safety management Technician, of the wood and similar industries Quality, Environment and safety management Technician, of the cork industries.

Table 10: Selection of Spanish Qualification Profiles related to In4Wood

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

Competence Unit	Training module	Skills/competences.
UC1361_3 - Planning and managing the warehouse and supplies in the furniture manufacturing industry.	MF1361_3 - Procurement and warehouse in the furniture manufacturing industry. 90 hours	EC1. Analyze purchasing and procurement programmes, according to a properly characterized logistics plan. EC2. Evaluate and characterize different stock management systems and their application in furniture manufacturing industries. CE3. Evaluate the procedures for stock control, which guarantee the supply in conditions, considering the optimal management system and the precise documentation for its implementation. EC4. Determine storage and transportation plans, applicable in the furniture industry, considering, among other things, the systems, means, standard procedures and conditions and care for proper reception.
UC1362_3 - Organize production in furniture manufacturing industries	MF1362_3 Production organisation in furniture manufacturing industries. 150 hours	EC1. Differentiate the materials needed in the manufacture of furniture. EC2. Analyze the organisational, functional and productive structure of the furniture industries. CE3. Analyze the necessary resources in the furniture industry for the production of furniture. EC4. Determine the production, optimizing the available resources, according to the established plan. EC5. Specify the water, air, cold, heat and electricity requirements of the machines and processes and supervise the operation and maintenance of the auxiliary services that ensure their supply. EC6. Formulate the technical information for the units of production, distributing it with the required clarity. CE7. Examine the production control program with the ratios established according to the manufacturing program.
UC1363_3 - Supervising and controlling production in furniture manufacturing industries	MF1363_3 Production control in furniture manufacturing industries 180 hours	EC1. Interpret and select the technical information necessary for the control of the production in furniture industries and process the standard documentation required for distribution. EC2. Control the cutting, machining, sanding and finishing operations in the production process of furniture manufacturing, management of available equipment and storage of finished products. CE3. Analyze automated manufacturing systems and processes used in the wood, furniture and cork industries, relating the different phases to materials, machines, installations and output products. EC4. Analyze methods and elaborate procedures for the control of the means of production in the industries of wood, furniture and cork, that ensure their set-up. EC5. Analyze the properties of the machine tools, equipment and facilities required for automated manufacturing in the wood and furniture industries, relating their performance to the field of application. EC6. Perform the programming of numerical control for the manufacture of pieces of carpentry and furniture, considering the requirements related to the product and the execution process specified in the technical information. CE7. Analyze, define and carry out operations of preparation, execution, control and maintenance of automated manufacturing equipment - saws, milling machines, drills and machining centers -, characteristic of the wood and furniture industry. CE8. Analyze and specify the conditions required for the launch of production in the wood, furniture and cork industries, and develop procedures to control their progress. CE9. Apply techniques of calculation of yields and improvement of the productivity of the manufacturing processes in the industry of the wood, furniture and cork. EC10. Apply techniques of maintenance and repair of the installations, machines and tools of the production of furniture. CE11. Identify the systems of assignment of tasks for the areas, equipment and people of a production unit.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

UC1364_3 - Participate in the maintenance of the systems of management of the quality, environment, prevention and occupational health in wood, cork and furniture	MF1364-_ Quality, Safety and Environment in furniture wood and cork industries. 90hours.	EC1. Analyze the essential aspects of quality systems in the wood, furniture and cork industry. EC2. Analyze the essential aspects of environmental management systems in the wood, furniture and cork industry. CE3. Analyze the characteristics of the raw materials needed to obtain the product. EC4. To determine the systems of control and improvement of the quality and the environmental management in processes of manufacture of products of wood, cork and furniture. EC5. Determine the reliability of wood, furniture and cork products in accordance with the appropriate product standards and by applying the appropriate test procedures. EC6. Assess the application of a quality system to the manufacture of the product. CE7. Analyze the safety conditions required for the development of production in the wood, furniture and cork industries and develop procedures for their control and prevention. CE8. Analyze and evaluate plans of safety and hygiene of companies of the sector of the wood, furniture and cork. CE9. Analyze the current legislation on safety and hygiene relative to the wood, furniture and cork sector EC10. Define and correctly use means and safety equipment used in the sector of wood, furniture and cork CE11. Perform emergency and fire actions according to a predefined plan. CE12. To analyze and evaluate cases of real accidents occurred in the companies of transformation of the wood and the cork and of manufacture of carpentry and furniture. CE13. Define and analyze the different types of waste generated by the furniture industry with the applicable systems of disposal and use in appropriate environmental conditions, optimizing resources.
UC1365_3 - Manage the park of wood and cork.	MF1365_3 Management of wood and cork parks.	EC1. Analyze purchasing and supply programmes for raw materials and wood and cork auxiliaries, according to the different logistics plans that ensure an optimum supply of raw materials. EC2. Analyze the reception processes, the wood industry and the cork, according to the operating procedure. CE3. Interpret the processes of storage, internal distribution and handling of the various supplies of the wood and cork industry, in accordance with the established operating procedure. EC4. To elaborate an information and documentation system that allows controlling the type, quality, quantity and situation of the existing materials and products, economic value through the control of the process in the wood and cork industry. EC5. Identify the optimal conditions of transfer that the goods of wood and cork must gather when carrying out external and internal transport, according to the current legislation of transport of forest products.
UC1366_3 - Control the manufacturing processes in the wood saw industries	MF1366_3 – Manufacturing control at wood saw industries	EC1. Recognize the characteristics of the raw material such as logs, depending on the age, thickness and performance of each piece of wood, depending on the demand and the possibilities of the product. EC2. To systematize the different parameters of procedure and control in the manufacture of sawn wood and by-products, analyzing the sequencing of the production process. CE3. Analyze the human and mechanical resources necessary for the production of sawn timber based on the established instructions, considering the production plans. EC4. Characterize the productive processes of debarking, parting, sawing, unfolding, edging, retreading and others, depending on the products manufactured through diagrams and schemes. EC5. To elaborate specific technical documentation regarding the product and the process in the industries of transformation of the sawed wood, through manual and computer means, referred to the system of management of the traceability and to other systems of management. EC6. Examine the operation and operations in the lumber industry, according to the operating system of the production process, in the manufacture of sawn wood, indicating the first level maintenance needs of the machines and production equipment.
UC1368_3 - Control the manufacturing processes in the board and laminated glue industries.	MF1368_3 Production control at wood based boards industries.	EC1. Recognize the characteristics of the raw material used in the production of panels and glued laminated wood, such as chips depending on the possibilities of the product. EC2. To elaborate specific technical documentation regarding the product and the process in the manufacture of boards and glued laminated wood, through manual and computer means, referred to the management system. CE3. Examine the operation and management of machines and equipment for the manufacture of boards and glued laminated wood, according to the principles and basic elements that regulate its operation and manufacturer's instructions. EC4. Analyze the production processes - cleaning, grinding, preparation, sanitation, gluing, drying, pressing among others -, depending on the materials and the product to be obtained, through diagrams and graphic representations. EC5. Characterize the productive processes of obtaining by-products of sawing, saw wood and veneers, explaining through diagrams the relationships between the different manufacturing areas and differentiating the continuous processes from the discontinuous ones. EC6. Examine the operation and the needs of the machines and equipment of manufacture of panels of glued laminated wood and the maintenance operations of first level, according to the principles and basic elements that regulate its operation and indications of the manufacturer.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

Table 11: Specification on Qualification Units from Professional Qualifications MAM423_3 and MAM424_3 related to In4Wood and their associated Training modules and Skills (Spain).

Italy

The Italian Furniture Manufacturing Sector and Industry 4.0

The fourth revolution is now a reality to which the operators of the furniture industry cannot escape. The sector, like most Italian industry, does not seem ready to seize all of the opportunities offered by this change due to lack of financial and human resources as well as factors outside the company. Machinery is just one of the tools and technologies key involved in the process of transforming the production system that **covers the entire value chain and must be inserted into a total factory reorganisation plan.**

Professional training is extremely needed on topics related to Industry 4.0 especially when it comes to Key Enabling Technologies for which the lack of knowledge is very high.

The level of knowledge of digital technologies for the industry presents significant differences between sectors: traditionally considered advanced domains such as automotive and specialised machines confirm their technological leadership with a high level of awareness.

Tailgates are industry sectors that are relevant to national GDP, such as the world of household appliances, **wood and furniture**, industrial fashion companies, with an ignorance peak of over 80%.

SMEs, we talk about 1 out of 3 companies, have a very low awareness of Industry 4.0.

55% of SMEs have no knowledge, only 7% of them have implemented some solutions.

Training and Education in Italian National Industry Plan 4.0

This is the starting point, but in our country there is the ability to adapt to change. But for this to happen, change must be decisive and aware. So you can only applaud the proposals recently advanced by the Government with its plan. New digital technologies applied to manufacturing require higher educational and cultural levels, people capable of both technology adoption and consequent use. Operators able to call things with the right name and professionalism that they know how to govern evolution in progress, knowing quickly discerning opportunities from false promises. We need strong technicians of their own skills and that they need to be more and more multidisciplinary, but also managers who have the company's vision and leadership capability aligned with today's context.

VOCATIONAL TRAINING (EQF 2-3-4)

Vocational training means a school-based, regional-level vocational training course for young people who want to enter the world of work immediately, without having to undertake long studies to obtain a degree. This path is parallel and differentiated from what the students follow in the path of national school education system (MIUR). The study path is currently varied and depends on the

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

typology of the Center frequented. In Italy, vocational training infrastructures have a two-year / three-year period of studies with a prevalence of specialist practical subjects in the field aimed at achieving a professional qualification.

An important contribution to vocational training is also provided by private training agencies that offer specialized training content on specific areas of vocational learning. Many courses offered by private entities, provided they are accredited by the Italian regions, are free of charge as they are funded with the European Community Social Fund resources. The accreditation of the training centres was started with the Decree of the Ministry of Labor no. 166 of May 26, 2001, received by the Regions which, pursuant to art. 117 of the Constitution, they then applied autonomously, and often very differently, the general criteria laid down there for the recognition of training agencies. In some regions, successive efforts were also made to accredit the staff involved in different roles in the realization of training activities funded by public resources. An important guarantee in terms of the quality of the courses was given.

Law 845/1978, still in force, provides that the regions cannot implement or authorize activities aimed at obtaining a degree or higher education diploma, university or postgraduate education (Article 8).

By passing the final exams, the students obtain certificates issued by the regions, according to which placement offices assign qualifications that are valid for work start-up and business enrollment. Certificates are the title for admission to public competitions (Article 14).

Therefore, the legal value of the certifications is theoretically limited to the issuing region.

They are entitled to the Ministry of Labor (Article 18): for the definition of professional qualifications, their technical, cultural and operational content and the evidence of their assignment; the activities of study, research, documentation, information and experimentation; the organisation and the funding, in agreement with the regions.

In the Italian National system Vocational Training can be attributed to levels from 2 to 4 of the European Qualifications Framework

QUALIFICATION	EQF	SECTOR	REPERTOIRE
Wood technician	4	Wood and furniture	Four-Year Professional Education and Training - Four Year IeFP
Wood operator	3	Wood and furniture	Three Year Professional Education and Training - Three Year IeFP
Technician for industrial automation	4	Mechanics, production and maintenance of machines, plant engineering	Four-Year Professional Education and Training - Four Year IeFP
Business Services Technician	4	Common area	Four-Year Professional Education and Training - Four Year IeFP

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

Mechanical operator	3	Mechanical operator	Three Year Professional Education and Training - Three Year IeFP
System operator and logistical services	3	Common area	Three Year Professional Education and Training - Three Year IeFP

Table 12: Vocational Training National Qualification Profiles related to In4Wood in Italy.

Source: http://nrpitalia.isfol.it/sito_standard/sito_demo/atlante_repertori.php

HIGHER EDUCATION AND TRAINING COURSES (EQF 4)

Higher Education and Training Courses (IFTS) are highly advanced postgraduate vocational training courses, developed in synergy between vocational training centers, higher education institutions, businesses and universities. IFTS is the Italian equivalence of post-secondary vocational education, attributable to the 4th level of the European Qualifications Framework.

IFTS courses are addressed to young people and adults, with or without work commitments, while respecting equal opportunities. Access to the IFTS courses is allowed for graduates [5], as well as those who, although not having a second degree secondary school diploma, demonstrate that they have the minimum cultural access requirements. Finally, IFTS issues a "superior technical training certificate" valid on Italian territory.

The higher education and training courses (IFTS) are aimed at obtaining a higher technical qualification certificate, for a 2 years duration for a total of 800-1000 hours and are realized through the unitary acquisition of:

- Common, linguistic, scientific and technological, legal and economic, organisational, communicative and relational competences;
- Technical-vocational skills related to specific specialisation sector.
- IFTS courses respond to an instance of technical and professional training based on the development of learning outcomes of technical and vocational education and training pathways. The definition and the declination of the Superior technical specialisations takes into account the physiognomy and articulation of the paths of higher technical institutes in order to avoid redundancies and overlaps.
- Minimum training standards for IFTS paths are "proven ability to use knowledge, personal, social and / or methodological abilities and skills, in work or study situations and in professional and personal development ".

The skills related to minimum training standards are taken as results of learning to obtain the certificate of higher technical specialisation according to the regulations in force.

Superior technical specialisations are described in terms of minimum standards training, taken at country level system, consistently, for each specialisation, in an organic set of technical and professional skills, declined in relation to areas of specialisation related to work processes and areas of activity of the figures of corresponding secondary level qualification. The specialisations are

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

described below "Broadband", in a perspective that can represent training standards corresponding to a "core" of valid and expedient skills in multiple and different contexts professional and working.

IFTS corresponds to the 4th level of the European Qualifications Framework.

QUALIFICATION	GENERAL COMPETENCE	COMPETENCE UNITS	FUNDAMENTAL PROFESSIONAL ACTIVITIES
SENIOR TECHNICIAN FOR DESIGN AND INDUSTRIAL DESIGN	The superior technician for industrial design and design has a high degree of expertise specifications in the different manufacturing sectors. In general, care for the creation of new products or new production lines, including through co-ordination and the integration of skills and resources in the company. It also cares for the development and design of particular components with the help of computer technology.	Apply drawing techniques and computer graphics Use visual communication and multimedia in design Use industrial design in design Manage an eco-efficient industrial process in a quality system Realize the prototype of the product Adopt marketing logic in the design-oriented company system	In developing and designing components of a product, in interpreting and executing its design, the Senior Technician for Industrial Design and Design carries out activities that, specifically, refer to the various production sectors, but which imply the following general competences: 1 apply drawing techniques and computer graphics; 2 use visual and multimedia communication in communication; 3 use industrial design in design; 4 manage an eco-efficient industrial process in a quality system; 5 realize the prototype of the product; 6 adopt marketing logic in the design-oriented company system.
SENIOR TECHNICIAN FOR INDUSTRIALIZATION OF PRODUCT AND PROCESS	The Senior Technician for product and process industrialization, in close integration with the product design, defining machining cycles, and adapting production technologies and the possible use of external resources (make or buy). He talks about problems related to the production process and the operation of the plants.	Analyze business structures based on production processes and related costs Adopting methods and design techniques in industrialization and product management Manage plant structures in the configuration of process and product systems Use the logics under continuous improvement: fighting waste at production Identify the objectives of quality policies in process utilization and product realization Realize processes and products in basic ergonomic environments and in compliance with safety standards	1 Detect and examine deviations from production parameters, quality standards, safety and the environment, to specific production problems; 2 adopt design methods and techniques in industrialization of the product; 3 manage plant structures in process and product system configuration; 4 make proposals for improving the production process and formalizing them (reporting activities); 5 to connect production needs with requests from other functions involved; 6 produce processes and products in ergonomic environments, assist staff in the event of problems and transfer knowledge in introducing changes and innovations (facilitator);
SENIOR TECHNICIAN FOR INDUSTRIAL INFORMATICS	The Senior Technician for Industrial Informatics cares for the maintenance and programming of control (plc, pc, supervisory processors) and data transmission. Collaborates in adapting software and hardware adaptations. Train and assist operators.	Managing industrial plant technologies Use CAD, CAM, CIM systems Administer and manage programmable logic controls Controlling and adjusting industrial processes Representing and monitoring process parameters Administering industrial communication networks	1 collaborate with the security officer and the quality manager in the application of the rules underlying the construction of machines and plants, as well as related to their installation, operation and maintenance; 2 Create programmes in various medium complexity languages on logical programming units (CAD, CAM, CIM); 3 install control and control units (PLCs), transducers and actuators, electronic, electromechanical, pneumatic and hydraulic; 4 collaborate in the design and management of the main industrial plants for control and control regulation of machines and for the transmission of data; 5 Examine data and obtain information from tables, charts, and other documentation in order to detect failures and anomalies, optimizing control and diagnosis procedures; 6 collaborate and interact with different business figures, from operators to machines and plants to those responsible for the organisation of staff and production.
SENIOR TECHNICIAN FOR MARKETING AND	The top commercial technician, for marketing and sales organisation, as it stands professional "broadband", carries out the	Use commercial English Read the economy of the territory Organize the activities of a commercial office	1 organize activities related to the distribution of business products / services;

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

ORGANISATION OF SALES	implementation of product and market strategies, as well the implementation of commercial and promotional policies. Collaborates in organizing and coordinating sales and distribution.	Communicating and promoting products, services and events Use strategic and operational marketing techniques	2 coordinate and integrate the skills and resources in the company in the fields: commercial, marketing, communication and distribution; 3 work and collaborate in the field of business communication, in some cases by organizing in the first place person, both events and events aimed at giving visibility to the image and the products / and / or services corporate, both the preparation of advertising material (catalogs and samples), in support of the business activities; 4 work and work in the field of marketing and commerce, in the implementation of the system marketing information, conducting targeted research, and / or managing customer processes satisfaction and market share, in a given geographic area, doing business with customers, by identifying their needs by collaborating to identify the most appropriate products and services;
SENIOR TECHNICIAN FOR PRODUCTION	The Senior Technical Manager is responsible for managing and coordinating the operations of the operating unit, heal the correction / adjustment of production operations, maintain operation and maintenance ordinary machine / plant, evaluating the production trend and proposing solutions ameliorative. It cares the training of the operators. This figure requires high specific skills in the various manufacturing sectors.	Programming production Managing industrial production Managing production facilities Applying operational management techniques and production control Making economic evaluations of production Developing industrialization of product and process Working in the quality assurance system and to pursue continuous improvement	1. Collaborate with the definition of the production program, in terms of quantity / quality, time, cost, efficiency and efficiency; 2. Manage industrial production; 3. Manage production facilities and human resources optimally for the realization of the production program; 4. Apply operational management and production control techniques, proposing initiatives for improve process efficiency and overall plant performance in unit specificity production; 5. Perform economic evaluations of production; 6. Collaborate in the development phase of industrialization of the product and process by defining technologies and production processes for the realization of new productions or improvements of existing productions; 7. Operate in the quality assurance system and pursue continuous improvement through control of production processes in attention profiles (quality, cost, performance, environmental impact, security, etc.), contributing to innovation and the development of competitiveness.
SENIOR TECHNICIAN FOR PROGRAMMING PRODUCTION AND LOGISTICS	The Senior Technician for Production Planning and Logistics cares about programming the advance of production, the internal logistic organisation (movements and warehouses) and external (supplies and dispatches).	- Operate in the integrated logistic system - Work out the layout of industrial plants - Manage continuous and intermittent production - Manage industrial warehouses - Organizing distribution network	1. Operate in the integrated logistic system, following the design and organisation of the phases of supply of materials, in connection with production and commercial areas; 2. elaborate the layout of industrial plants; 3. supervise and control the management of batch production; 4. manage industrial warehouses by organizing the operations of transport, handling and handling systems storage of materials, with the aim of optimizing the flow of goods; 5. organize the distribution network, from computerized order management to verification of the related deliveries, correcting any dysfunction; 6. design and manage customer service.
SENIOR TECHNICIAN FOR THE COMPANY INFORMATION SYSTEM	The Superior Technician for the company information system cares about personalization, interfacing and the use of ERP products; coordinates staff in activating and adjusting business procedures to the tool computer; train and assist operators.	Encrypt and store the information Administer hardware and software components of information systems Administration of business networks Use programming languages Team work Administration of information systems	1 Select and analyze the business processes for which applications are to be developed, based on the needs of the various sectors; 2 Assist the EDP manager in the Business Information System project based on the employment of new technologies; 3 to foster the development and management of the business information system in an integration perspective various business functions; 4 collaborate with commercial and financial / administrative offices in the collection, analysis and in data interpreting, to optimize corporate management control; 5 develop new operational interface software applications between the ERP system and the operators business; 6 organize staff training activities.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

Table 13: Higher Education Qualification Profiles related to In4wood in Italy.

Source: http://archivio.pubblica.istruzione.it/dg_post_secondaria/figure_nazionali.shtml

HIGHER TECHNICAL INSTITUTES (EQF 5)

The Higher Technical Institutes (ITS) are institutes of excellence with advanced technological specialisation, whose offer is arranged in ornamental paths. They constitute the **non-university tertiary education segment** that **meets the demand of companies with new and high technical and technological skills to promote innovation processes.**

The Higher Technical Institutes (ITS) are the new "special technology schools". The ITS represent, in Italy, the new post-secondary training channel parallel to the university. In these courses, "superior technicians" are trained in technology areas considered to be strategic at national level. They are made, on a proposal from a technical institute or a professional institute, based on regional planning, forming a foundation of participation in various realities. The courses generally have a duration of 4 semesters for 1800/2000 hours, featuring laboratory teaching and mandatory internships for a fixed hour. The courses are characterized by the fact that a good deal of teachers come from the world of work and professions. The title issued is the "Diploma di Scuola Superiore" diversified by specialisation.

The Higher Technical Institutes (ITS) correspond to the 5th level of the European Qualifications Framework.

QUALIFICATION	GENERAL COMPETENCE	SKILLS IN OUTCOME
Senior Technician for Process, Product, Communication and Marketing Technician for the Furniture Industry	The senior technician works in the production chains of the home furnishing and new technologies that improve the quality of living. He performs design and feasibility studies in accordance with international, national and national standards of quality, safety and compliance. He manages the machining cycles and the control procedures of the technological systems. He/she promotes process and product innovation with particular care in the choice of materials. He collaborates on the definition of company marketing and communication plans	- collaborating to the planning, realization and maintenance of products - carrying out market research and carry out technical and economic analysis of materials, finishes and innovative technologies - Producing project design documentation - planning the implementation of the project - carrying out audits, tests and tests - proposing innovative technological solutions
Senior technician for process and mechanical innovation	Senior technician for process and mechanical innovation works in the field of design and industrialization, including the use of materials, processes and products, from the economic, regulatory and security bases to all aspects of design, up to the use of representation and simulation software	- Cooperating in all segments of the chain from production to marketing - managing production flows - developing and implement design, prototyping and industrialisation techniques - Identifying materials - Programming industrial automation systems

Table 14: Higher Technical Institutes Qualification profiles related to In4wood in Italy.

Source: http://hubmiur.pubblica.istruzione.it/web/istruzione/area-its/normativa-its

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

Within the mentioned families of Qualification Profiles existing at national level in Italy that are related to In4wood sectors and competences 2 profiles have been selected as the most interesting to be integrated with In4wood skills and competences framework.

QUALIFICATION	GENERAL COMPETENCE	COMPETENCE UNITS	FUNDAMENTAL ACTIVITIES PROFESSIONAL
IN HIGHER EDUCATION AND TRAINING COURSES PROFILES (EQF 4)			
SENIOR TECHNICIAN FOR DESIGN AND INDUSTRIAL DESIGN	The superior technician for industrial design and design has a high degree of expertise specifications in the different manufacturing sectors. In general, care for the creation of new products or new production lines, including through co-ordination and the integration of skills and resources in the company. It also cares for the development and design of particular components with the help of computer technology.	Apply drawing techniques and computer graphics Use visual communication and multimedia in design Use industrial design in design Manage an eco-efficient industrial process in a quality system Realize the prototype of the product Adopt marketing logic in the design-oriented company system	In developing and designing components of a product, in interpreting and executing its design, the Senior Technician for Industrial Design and Design carries out activities that, specifically, refer to the various production sectors, but which imply the following general competences: 1 apply drawing techniques and computer graphics; 2 use visual and multimedia communication in communication; 3 use industrial design in design; 4 manage an eco-efficient industrial process in a quality system; 5 realize the prototype of the product; 6 adopt marketing logic in the design-oriented company system.
IN HIGHER TECHNICAL INSTITUTES PROFILES (EQF 5)			
QUALIFICATION	GENERAL COMPETENCE	SKILLS IN OUTCOME	
Senior Technician for Process, Product, Communication and Marketing Technician for the Furniture Industry	The senior technician works in the production chains of the home furnishing and new technologies that improve the quality of living. He performs design and feasibility studies in accordance with international, national and national standards of quality, safety and compliance. He manages the machining cycles and the control procedures of the technological systems. He/she promotes process and product innovation with particular care in the choice of materials. He collaborates on the definition of company marketing and communication plans	-collaborating to the planning, realization and maintenance of products - carrying out market research and carry out technical and economic analyzes of materials, finishes and innovative technologies - Producing project design documentation - planning the implementation of the project - carrying out audits, tests and tests - proposing innovative technological solutions	

Table 15: Selection of National Qualification Profiles related to In4wood in Italy.

United Kingdom

The furniture sector in the United Kingdom:

UK furniture (and allied sub-sectors) manufacturing is a substantial industry. According to Government statistics its 8,113 companies contribute £21.1 billion to the country's GDP (10% up on previous year), which equates to 2.2% of manufacturing output. Over a quarter of a million jobs are dependent on the success of the industry, with 107,000 in manufacturing alone. There are 150,000 jobs in specialist furniture and furnishings retail and wholesale, 3,000 in repair, 10,000 in leasing, plus a proportion of the 52,000 registered specialist designers. Consumer expenditure on furniture

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

and furnishings equates to £18.2 billion per year and is rising. During the recession, high-end craft-craft furniture manufacture increased output by 17%.

The UK Furniture sector covers the manufacture of:

- Cabinets
- Chairs and seats
- Office furniture
- Contract furniture *e.g. shops, hospitals, hotels, schools*
- Kitchen furniture
- Mattresses
- Other furniture

Additional industries include:

- Manufacture of soft furnishings

UK Furniture Skills

The sector's continued growth relies on the ability to access specialised skills across the country. As the United Kingdom leaves the European Union, at this stage, it is assumed that the industry will not have the same unfettered access to the European employment pool that it currently does. The British furniture industry is heavily reliant on skills, the majority of which are only currently available from non-UK workers. Whilst the sector will continue lobbying Government to improve UK skills provision, it is likely that if restrictive work visa requirements prevent access to skilled EEA workers there would be a significant industry skills gap between the restriction of EEA workers and the completion of training skilled UK workers, particularly in the advanced and more technical roles.

Skills gaps and shortages are acutest in the following furniture specific roles / technologies:

- Process Control
- Safety Testing
- Advanced Design
- Robotics
- Sensor Enablement
- Automation

The sector is in two parts – the more traditional craft high-end furniture manufacture and the mass-produced, highly customised furniture production. The former requires advance levels of highly skills craft workers; whilst the latter is changing and advancing quickly, taking advantage of innovations using Industry 4.0.

Newly developed qualifications and associated curriculum are gradually tailored more towards the future needs of the sector, although take up is still rather slow compared to other sectors.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

Professional Qualifications.

There are no imposed entry requirements for the Apprenticeship or Advanced Apprenticeship for the Furniture, Furnishings and Interiors Manufacturing industry. There are recommendations relating to the basic skills requirements that would be useful to have before beginning the programme. To enter the industry, it is desirable that you have a good basic education, Maths and English would be good. Apprentices will develop skills using their hands and specialist equipment whilst learning about furniture materials and production methods. They will also have the chance to do qualifications that can take them into technical, supervisory or management occupations, possibly running their own business.

The UK apprenticeship system is undergoing major reform. The furniture industry has developed a range of professional standards for apprenticeships of the future. UK apprenticeship standards specify the skills, knowledge and behaviours expected of the apprentices. The professional standards do not dictate the actual training or qualifications required to gain the required skills, knowledge and behaviours. Employers are free to access any type of training or qualifications that fit in with their business operation and the students learning style. The skills and knowledge are measured and assessed against the professional standard by independent Government Assessment Centres.

Most people train and gain qualifications as they work through an apprenticeship, although there are other kinds of training programmes. Currently there are around 2,500 apprenticeships per year in the sector across the full range of operational, production, technical, managerial and administrative job roles.

The furniture manufacturing industry expects to have a workforce with a greater average age in 5 year's time than it has now. This is a real cause for concern as companies reported an average workforce age of 41 to 50 and with a current preference for employing the older individual this ageing effect will be compounded. Anecdotal evidence suggests that companies will be stimulated to employ more youngsters in conjunction with the development of more effective, better understood training provision. This reinforces the importance of being able to facilitate the introduction of these individuals into companies, thus encouraging organisations to embrace the system rather than feeling that they have to keep jumping over unexpected hurdles.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

NQF Level	Descriptor
1	Has basic factual knowledge of a subject and/or knowledge of facts, procedures and ideas to complete well-defined routine tasks and address simple problems; and Is aware of aspects of information relevant to the area of study or work. Use basic cognitive and practical skills to complete well-defined routine tasks and procedures. Selects and uses relevant information. Identifies whether actions have been effective.
2	Has knowledge and understanding of facts, procedures and ideas in an area of study or field of work to complete well-defined tasks and address straightforward problems. Can interpret relevant information and ideas. Is aware of a range of information that is relevant to the area of study or work. Select and use relevant cognitive and practical skills to complete well-defined, generally routine tasks and address straightforward problems. Identify, gather and use relevant information to inform actions. Identify how effective actions have been.
3	Has factual, procedural and theoretical knowledge and understanding of a subject or field of work to complete tasks and address problems that while well-defined, may be complex and non-routine. Can interpret and evaluate relevant information and ideas. Is aware of the nature of the area of study or work. Is aware of different perspectives or approaches within the area of study or work. Identify, select and use appropriate cognitive and practical skills, methods and procedures to address problems that while well-defined, may be complex and non-routine. Use appropriate investigation to inform actions. Review how effective methods and actions have been.
4	Has practical, theoretical or technical knowledge and understanding of a subject or field of work to address problems that are well defined but complex and non-routine. Can analyse, interpret and evaluate relevant information and ideas. Is aware of the nature of approximate scope of the area of study or work. Has an informed awareness of different perspectives or approaches within the area of study or work. Identify, adapt and use appropriate cognitive and practical skills to inform actions and address problems that are complex and non-routine while normally fairly well-defined. Review the effectiveness and appropriateness of methods, actions and results.
5	Has practical, theoretical or technological knowledge and understanding of a subject or field of work to find ways forward in broadly defined, complex contexts. Can analyse, interpret and evaluate relevant information, concepts and ideas. Is aware of the nature and scope of the area of study or work. Understands different perspectives, approaches or schools of thought and the reasoning behind them. Determine, adapt and use appropriate methods, cognitive and practical skills to address broadly defined, complex problems. Use relevant research or development to inform actions. Evaluate actions, methods and results.
6	Has advanced practical, conceptual or technological knowledge and understanding of a subject or field of work to create ways forward in contexts where there are many interacting factors. Understands different perspectives, approaches or schools of thought and the theories that underpin them. Can critically analyse, interpret and evaluate complex information, concepts and ideas. Determine, refine, adapt and use appropriate methods and advanced cognitive and practical skills to address problems that have limited definition and involve many interacting factors. Use and, where appropriate, design relevant research and development to inform actions. Evaluate actions, methods and results and their implications.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

7	Reformulates and uses practical, conceptual or technological knowledge and understanding of a subject or field of work to create ways forward in contexts where there are many interacting factors. Critically analyses, interprets and evaluates complex information, concepts and theories to produce modified conceptions. Understands the wider contexts in which the area of study or work is located. Understands current developments in the area of study or work. Understands different theoretical and methodological perspectives and how they affect the area of study or work. Use specialised skills to conceptualise and address problematic situations that involve many interacting factors. Determine and use appropriate methodologies and approaches. Design and undertake research, development or strategic activities to inform or produce change in the area of work or study. Critically evaluate actions, methods and results and their short- and long-term implications.
8	Develops original practical, conceptual or technological understanding to create ways forward in contexts that lack definition and where there are many complex, interacting factors. Critically analyses, interprets and evaluates complex information, concepts and theories to produce new knowledge and theories. Understands and reconceptualises the wider contexts in which the field of knowledge or work is located. Extends a field of knowledge or work by contributing original knowledge and thinking. Exercises critical understanding of different theoretical and methodological perspectives and how they affect the field of knowledge or work. Use advanced and specialised skills and techniques to conceptualise and address problematic situations that involve many complex, interacting factors. Formulate and use appropriate methodologies and approaches. Initiate, design and undertake research, development or strategic activities that extend or produce significant change in the field of work or study. Critically evaluate actions, methods and results and their short- and long-term implications for the field of work or knowledge and its wider context.

Table 16: The eight qualification levels in the English Qualification Framework.

There are 25 professional and vocational qualifications related to Furniture and allied sub-sectors from levels 3 to 5. There are an additional 20 vocational qualifications at levels 1 and 2 offered by a number of other UK Awarding Organisations but these are duplicates of those listed below:

Ref	Qualification Title	UK NQF Level	EQF Level	Total Learning Hours
603/0205/7	OAL Level 2 NVQ in Finishing Furniture	2	3	746
601/7732/9	OAL Level 2 Diploma In Furniture Installation	2	3	440
601/7733/0	OAL Level 2 Diploma In Furniture Making	2	3	560
603/0209/4	OAL Level 2 NVQ in Furniture Restoration	2	3	1114
601/7611/8	OAL Level 2 NVQ Diploma in Fitted Furniture Installation	2	3	490
601/7627/1	OAL Level 2 NVQ Diploma in Furniture and Wood Processing	2	3	770
601/7734/2	OAL Level 2 Diploma In Furniture Spray Finishing Methods	2	3	450
603/0208/2	OAL Level 2 NVQ in Furniture Making	2	3	621
603/0212/4	OAL Level 2 NVQ in Modern Furniture Service Repair	2	3	741

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

601/7609/X	OAL Level 2 NVQ Diploma in Finishing Furniture	2	3	480
601/7607/6	OAL Level 2 NVQ Diploma in Furniture Making	2	3	440
603/0206/9	OAL Level 2 NVQ in Fitted Furniture Installation	2	3	1027
601/7731/7	OAL Level 2 Diploma In Furniture Finishing Methods	2	3	540
603/0183/1	OAL Level 2 in Understanding the Furniture, Furnishings & Interiors Industry	2	3	479
603/0207/0	OAL Level 2 NVQ for Furniture CNC Technician	2	3	894
601/7628/3	OAL Level 2 NVQ Diploma in Furniture and Wood Processing	2	3	835
601/7608/8	OAL Level 3 NVQ Diploma in Furniture Making	3	4	540
601/7738/X	OAL Level 3 Diploma In Furniture Design and Making	3	4	840
601/6659/9	OAL Level 3 NVQ Diploma in Furniture and Wood Processing	3	4	680
601/7612/X	OAL Level 3 NVQ Diploma in Fitted Furniture Installation	3	4	550
600/1978/5	OAL Level 3 Diploma in Furniture Design and Making	3	4	840
601/7610/6	OAL Level 3 NVQ Diploma in Finishing Furniture	3	4	520
500/8980/8	City & Guilds Level 3 NVQ Diploma in Design in the Furniture, Furnishings and Interiors Industry	3	4	600
601/6657/5	OAL Level 3 NVQ Diploma in Furniture and Wood Processing Technician	3	4	1080
601/8718/9	OAL Level 5 Certificate in Furniture Exporting	5	5	195

Table 17: UK In4wood related profiles

There are currently **NO** vocational or professional furniture industry specific qualifications available in the UK that match the In4wood project specification. The UK furniture industry is redeveloping its Furniture Management and Senior Technical qualifications, but these are not due to be available until later in 2019.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

Germany

The furniture and woodworking sector in Germany.

In 2013, the German furniture industry produced 103,278,710 pieces of furniture; that is around 460,000 pieces of furniture produced per working day. Just over 30 million of these were sold abroad, the remaining majority in Germany. In 2013 the German furniture industry achieved total sales of euro 16.1 billion. With well-trained skilled workers, the industry produces excellent furniture, which is unrivalled worldwide. 84,220 men and women work in 518 companies. Worldwide, Germany ranks third after Italy and China among all furniture exporting nations.

In the first half-year 2014 the German furniture industry achieve a 1.6 percent increase in sales. The individual segments of the furniture industry developed very differently. The office furniture industry with sales of around € 959 mln recorded a slightly positive result (+1.4 %). The shop furniture manufacturers on the other hand were around 6.8 percent below the previous year's value and achieved sales of around € 681 mln. The kitchen furniture manufacturers recorded a marked increase in sales by 3.1 percent to around € 2.2 bln. The manufacturers of domestic furniture also reported growth; their sales improved by 1.9 percent to around € 3.9 bln. This value also includes upholstered furniture, whose growth is also 1.9 percent to around € 526 mln. The mattress manufacturers also contribute with a clear rise in sales of 8.7 percent to around € 384 mln.

The German furniture industry is continuing to grow: the turnover of domestic companies rose by 3.1 percent to € 4.5 billion in the first quarter of the current year.

At the same time, domestic sales rose by 2.8 percent and foreign sales by 3.9 percent. The good labor market situation, the rising income of domestic consumers and the good foreign demand for furniture "Made in Germany" explain this growth.

Last year, German furniture manufacturers were able to increase their sales by 3.2 percent to the record value of just under € 18 billion. The Association of the German Furniture Industry expects that the previous year's result will be exceeded in the current year as well. At the end of March 2017, the German furniture industry employed 84,241 people in 496 companies[9].

Professional Qualifications related to furniture and woodworking industries in Germany.

Some centuries ago there were quite a number of professions working with wood as the main and very versatile raw material, like brush and paintbrush makers, cooper, etc. which are nearly extinct today. The actual list of professions in Germany which mainly are working with wood includes:

- Joiner (furniture production and interior finishing)
- Carpenter (timber construction)
- Wood processing mechanic (primary wood processing)

[9] Source: The Association of the German Furniture industry. www.holzindustrie.de

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

- Wood mechanic (industrial production of furniture, wooden building elements and packaging)
- Parquet recliner
- Wood sculptor
- Maker of woodwind musical instruments
- Maker of plucked musical instruments.
- Wooden toy maker

For each of these professions there is an enactment issued by the Federal Minister of Economy and Technology. It describes in detail the duration (usually three years), aims, and content of the vocational training and of the exams. In addition, the Conference of the German states Ministries of Culture and Education issues a curriculum for the schooling part of the dual system.
Below is the systematic list of training occupations in the wood sector, where professional designations, training areas, duration, DQR level and training regulations are specified.

Ref.	General Competence	Competence units / Learning Fields (LF)	Relevant occupations and workplaces.
223202 Woodworking Mechanic.	Woodworking mechanics make use of machines and equipment with which they operate and maintain sawn timber, planed timber, boards, veneer and chipboard as well as other wooden materials. They plan and coordinate the necessary work steps, select and control the required materials, monitor and optimize the production processes. Finally, they check whether the wood has been processed correctly and that the company's and statutory quality standards have been complied with. In addition, they prepare the finished products for storage or shipping.	LF1. - Select wood for production. LF2. - Making simple wood products. LF3. - Dry wood naturally. LF4. - Sharpening tools. LF5. - Making sawn timber. LF6. - Make planed goods. LF7. - Perform wood preservation measures. LF8. - Produce glued timber products. LF9. - Manufacture wood materials. LF10. - Measure and sort wood products. LF11. - Segment logs and optimize raw material usage. LF12. - Repair and equip tools. LF13. - Kiln-dry wood products. LF14. - Make special wood products.	Employment: Woodworking Mechanics find employment in: -Factories of the sawmill industry. -Planning, wood glue construction and wood-based panel industry -Furniture manufactures or woodworking machines. Training type: Dual education in industry (regulated by training regulation).
22342 – Wood processing mechanic: Specialisation "Manufacture of furniture and interior components".	Wood mechanics specializing in the production of furniture and interior fittings manufacture tables and seating furniture as well as shelving systems and shop fittings made of wood and wood-based materials. For this purpose, they prepare wood, process lumber and veneers as well as plastics with computer-controlled machines or systems and treat the surfaces. For example, assemble the items together with nails, screws or glue, among other things. Fittings and hinges. They check the products for functionality package and store them professionally.	LF1. - Manufacturing simple products made of wood. LF2. - Manufacturing composite products from wood and wood-based materials. LF3. - Manufacturing products from different materials. LF4. - Manufacturing small furniture. LF5. - Manufacturing individual furniture. LF6. - Manufacturing modular furniture. LF7. - Manufacturing and install built-in furniture. LF8. - Create and install room-limiting elements of the interior. LF9. - Manufacturing interior components. LF10. - Build building final components. LF11. - Manufacturing furniture industrially.	Employment: -At furniture manufacturers. -In companies, whose main activity is the manufacture of interiors from wood. -In interior design companies. Training type: Dual education in industry (regulated by training regulation)
	Carpenters are involved in craft workshops where they perform	LF1. - Manufacturing simple products made of wood.	Employment: -In carpentry.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

22393 - 103 – Carpenter	supervisory and coordinating tasks in the manufacture, assembly and repair of products made of wood and wood-based materials and, if necessary, they cooperate in a practical way. They ensure the quality and marketing of the products, train apprentices and look after customers, employees and suppliers.	LF2. - Manufacturing composite products of wood and wood-based materials. LF3. - Manufacturing products from different materials. LF4. - Manufacturing small furniture. LF5. - Manufacturing individual furniture. LF6. - Manufacturing modular furniture. LF7. - Manufacturing and installation of built-in furniture. LF8. - Create and install room-limiting elements of the interior. LF9. - Manufacturing and installation of interior components. LF10. - Build and finalize building components. LF11. - Maintenance and conservation processes.	-In interior construction businesses. -In window manufacturing. -At furniture manufacturers.
282342 – Upholsterer	Upholsterers make upholstered furniture and mattresses.	LF1. - Occupation and training within a company. LF2. - Create simple objects on an order basis. LF3. - Apply cushioning techniques. LF4. - Create simple seat cushions. LF5. - Manufacturing of high upholstery. LF6. - Cut upholstery and cover materials. LF7. - Manufacturing of upholstery covers. LF8. - Manufacturing of armrest and backrest upholstery. LF9. - Manufacturing of reclining furniture. LF10. - Creating cushion pads and moldings. LF11. - Carry out final assembly and quality control of sitting and lying furniture. LF12. - Develop production concepts for prototype	Employment: -In factories of the upholstered furniture industry -In factories specializing in the production of mattresses. -In specialist companies of the interior design trade. Upholsterer is a 3-year recognized training occupation in the industry.

Table 18: Qualifications within German Qualification Framework related to In4wood.

Competence Units	**Skills/competences.**
223202 – Woodworking Mechanic.	
LF1. - Select wood for production. 80 Hours.	- Selection skills of raw wood for the production of wood products according to the rules of dimensions and quality. - Internalization of safety at work, especially in storage and transport. - Knowledge of the types of wood and its characteristics, both general and specific to the species. - They deal with the forestry situation at an economic and sustainability level. - Capacity of material selection with projection to the subsequent production.
LF2. - Making simple wood products. 80 hours.	- Knowledge about the processes of wood production and ability to choose the right process for the processing of orders. - Identification of the manufacturing process as part of the commercial process. - Selection of tools and configuration of machines. - Knowledge on safety and health in the workshop work. - Control of the quality of the surface and the dimensional stability of the product. - Documentation of results.
LF3. - Dry wood naturally. 60 hours.	- Knowledge about the effects of moisture on wood and its changes during storage, processing and application of products. - Planning the outdoor drying of the wood. - Control of drying factors throughout the process. - Registration and evaluation of data.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

LF4. - Sharpening tools. 60 hours.	- Students recognize cutting errors, which are related to different tools and are able to determine their causes. - Review, control and repair of tools following safety standards and selecting the most appropriate procedure.
LF5. - Making sawn timber. 60 hours.	- Planning the production of sawnwood products by selecting suitable production methods and tools. - They carry out production taking into account economic efficiency and job security. They monitor and control the production process. They control the dimensions, quantities and quality of the products and take corrective measures if necessary. - Prepare the main products, by-products and residual wood for storage and transport.
LF6. - Make planed goods. 40 hours.	- Production planning according to the order of the orders. - They put the wood to the test to stay in shape. Select the right tools and configure the machines. - They carry out production according to job security. They monitor and control the production process. - Control the dimensions and quality of the products and take corrective measures if necessary. They pack, label, transport, store the brushing products and prepare them for shipment.
LF7. - Perform wood preservation measures. 40 hours.	- The students recognize and distinguish the characteristics of the wood caused by the plagues of xylophages, as well as the climatic influences. They know the procedures of application of chemical products to protect the wood. - Students select the appropriate protection measures in order and weigh the ecological aspects with the requirements of the conservation of the wood. - Carry out adequate measures for the preservation of wood, evaluate the measures taken and document them. - When carrying out measures to protect the wood, respect the rules of safety, health and environmental protection.
LF8. - Produce glued timber products. 40 hours.	- Planning of the production of products assembled with binders. - Knowledge about binders and their joining methods. - Selection of raw materials, adhesives and suitable tools. - Monitoring and control of the production process. - Conducting technical tests to control the quality of the product. - Prepare products for storage and transportation.
LF9. - Manufacture wood materials. 60 hours.	- Knowledge of the materials derived from wood, its properties and its production. - Selection of responsible raw material, avoiding contamination and deforestation. - They deal with sustainability issues in the production of the product. - Monitor production data and control the production process and transportation processes. - Laboratory control of the raw material. - Inspection of the final product at the mechanical and finishing level. Corrections. - Data control.
LF10. - Measure and sort wood products. 40 hours.	- Measurement and classification of wood and its derivatives. Knowledge about regulations and commercial issues. - Calculation of the quantities of material for the manufacture of the product. Use of different measurement tools. Use of adequate software and hardware. - Control of dimensional accuracy and humidity. - Labeling of wood products classified for different countries.
LF11. - Segment logs and optimize raw material usage. 60 hours.	- Selection of the suitable raw material and optimization for its use. - Division and cutting of logs. Determination of the optimal cut graphically by computer or with suitable measurement methods. - Storage of round wood ordered by order or diameter until further processing. - Optimization of the material according to the technological, economic and ecological aspects.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

LF12. - Repair and equip tools. 60 hours.	- Repair of machine tools. - Revision of the tool for wear and damage. - Selection of appropriate procedures and tools for repair. - Control of the saw blades, revision of the residual stress and the irregularity of the leaves.
LF13. - Kiln-dry wood products. 60 hours.	- Control of technical drying of wood. - The drying process is monitored and corrected by computer. - Review the dry product, analyze the drying results and develop ways to improve the process.
LF14. - Make special wood products. 100 hours.	- Skills planning, control and correction of the production process of the product from obtaining the raw material to the final piece.

Competence Units	**Skills/competences.**
22342 – Wood mechanic: Specialisation "Manufacture of furniture processing and interior components".	
LF1. - Manufacturing simple products made of wood. 80 hours.	- Skills to produce simple products made of wood, taking into account all the specific requirements of the work, such as orders to suppliers, selection of material, planning of the production process ...
LF2. - Manufacturing composite products from wood and wood-based materials. 80 hours.	- Skills to design and build composite wood products and wood products related to work and make joint decisions in teams.
LF3. - Manufacturing products from different materials. 80 hours.	- Competencies to register work orders for the manufacture of products made of different materials and to manufacture the products taking into account the specific properties of the material.
LF4. - Manufacturing small furniture. 80 hours.	- Competencies to design, plan and produce small furniture according to the specific requirements of the order.
LF5. - Manufacturing individual furniture. 80 hours.	- Competence to design, plan and produce furniture individually and as a team, according to customer orders.
LF6. - Manufacturing modular furniture. 60 hours.	- Skills to plan, manufacture and assemble modular furniture, taking into account the peculiarities of rational production.
LF7. - Manufacturing and install built-in furniture. 60 hours.	- Competence to manufacture and assemble built-in furniture according to the customer's request.
LF8. - Create and install room-limiting elements of the interior. 80 hours.	- Competence to plan, manufacture and assemble interior design elements based on orders.
LF9. - Manufacturing interior components. 80 hours.	- Competences to produce components of the interior design according to the description and order of the client.
LF10. - Build building final components. 80 hours.	- Competencies and skills to design, plan and produce construction elements according to the customer's request.
LF11. - Manufacturing furniture industrially. 60 hours.	- Competences and abilities to produce a specific piece of furniture and its interior equipment in consideration of serial industrial production.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

Competence Units	Skills/competences.
22393 - 103 – Carpenter	
LF1. - Manufacturing simple products made of wood. 80 hours.	- Planning simple wood products. - Selection of the types of wood suitable according to their characteristics and considering aesthetic, economic and ecological aspects. - Skills for product standardization. - Skills for computer design of products and realization of the pertinent calculations. - Workplace configuration according to the regulations and ergonomic requirements.
LF2. - Manufacturing composite products of wood and wood-based materials. 80 hours.	- Skills to design and build composite wood products and wood products related to work and make joint decisions in teams. - Definition of product requirements and their quality characteristics. - Selection of suitable assemblies. - Knowledge of measurement methods. - Knowledge of the use of tools and machinery.
LF3. - Manufacturing products from different materials. 80 hours.	- Production of products made of different materials. - Control of work orders for the production of products. - Competences for the understanding of technical documents. - Skills for the previous design based on ecological, economic and production criteria. Choice of constructive solutions.
LF4. - Manufacturing small furniture. 80 hours.	- Competencies to design, plan and produce small furniture according to the specific requirements of the order. - Harmonization of aesthetic and functional requirements with technical and construction requirements.
LF5. - Manufacturing individual furniture. 80 hours.	- Skills for the design, planning and production of individual furniture. - Ability to develop design variants based on customer orders. - Development of solutions based on aesthetic, functional and constructive aspects. - Use of software and hardware. - Skills for the realization of individual pieces, taking into account assemblies and finishes.
LF6. - Manufacturing modular furniture. 60 hours.	- Skills to plan, manufacture and assemble modular furniture, taking into account the peculiarities of rational production.
LF7. - Manufacturing and installation of built-in furniture. 60 hours.	- Skills and competences for the design, planning, manufacturing and assembly of built-in furniture according to the client's requirements.
LF8. - Create and install room-limiting elements of the interior. 80 hours.	- Registration of customer orders, ability to design, plan, manufacture and assemble coatings, partitions and parquet floors for interior assembly. - Knowledge of the use of specific tools. - Competences for the analysis of the construction process.
LF9. - Manufacturing and installation of interior components. 60 hours.	- Skills to plan, manufacture and assemble interior doors and stairs according to a customer's request. - Control of structural conditions, customer advice and product design.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

LF10. - Build and finalize building components. 100 hours.	- Knowledge of the control and sale of a carpentry product. - Skills to develop and define with the client the requirements for windows and exterior doors. - Preparation of documents for production and installation. - Knowledge on structural properties of buildings for the correct design, manufacture and assembly of the carpentry product.
LF11. - Maintenance and conservation processes. 40 hours.	- Skills for the control, maintenance, damage assessment and repair of carpentry products installed on site.

Competence Units	**Skills/competences.**
282342 - Upholsterer	
LF1. - Occupation and training within a company. 40 hours.	- Competence to present their job description in the training companies.
LF2. - Create simple objects on an order basis. 80 hours.	- Competence to plan and produce simple objects, taking into account the economic and technological requirements.
LF3. - Apply cushioning techniques.80 hours.	- Competence to use different upholstery techniques, apply orders and know the special characteristics of furniture structures. - Carrying out the upholstery work in accordance with ergonomic standards and requirements.
LF4. - Create simple seat cushions. 80 hours.	- Competence to produce simple seat cushions according to regulations. - Analyze job assignments based on technical documents regarding dimensional design and shape adjustment of simple seat cushions (flat upholstery). - Analyze upholstered structures with the aim of describing and differentiating production processes.
LF5. - Manufacturing of high upholstery. 80 hours.	- Competition to produce high cushions according to regulations. - Knowledge in realization of cutting plans.
LF6. - Cut upholstery and cover materials. 60 hours.	- Competence to adapt the upholstery and the materials to the structure of the furniture. - Knowledge and interpretation of technical documents. - Ability to choose materials for upholstery, foam and fabrics based on their properties. - Capacity to calculate the amount of material and waste, taking into account the specific conditions as well as economic and ecological aspects for different upholstery constructions and cutting types.
LF7. - Manufacturing of upholstery covers.80 hours.	- Competition to produce upholstery according to the customer's request. - Evaluation of the properties of upholstery materials and auxiliary materials and their aesthetic aspects, related to production as well as care and cleaning.
LF8. - Manufacturing of armrest and backrest upholstery. 60 hours.	- Competence to produce upholstery of arms and backrests according to the order. - Analyze work orders on the basis of technical documentation, especially cutting patterns, taking into account ergonomic requirements. - Skills for the creation of workflow plans and material calculation. - Control of work times.
LF9. - Manufacturing of reclining furniture. 80 hours.	- Competence to manufacture reclining furniture to order.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

LF10. - Creating cushion pads and moldings. 60 hours.	- Competence to produce cushions and pillow moldings on request. - Ability to choose materials for specific jobs. - Planning of work processes using the necessary equipment and taking into account safety and health and environmental specifications.
LF11. - Carry out final assembly and quality control of sitting and lying furniture. 80 hours.	- Competition to assemble upholstery, design functional and additional elements for seats and reclining furniture. - QA.
LF12. - Develop production concepts for prototype. 60 hours.	- Competence to develop concepts related to the orders for the production of upholstered furniture. - Knowledge of design, standardization and new trends.

Table 19: Qualification Units from Professional Qualifications related to In4wood and their associated Training Units and Skills.

ESCO competences analysis

Once the national profiles deriving from the National Qualification Frameworks have been selected, the analysis of European profiles tracked by ESCO portal has been carried out in order to harmonize national results with the European level.

A search by occupation related to the furniture and wood manufacturing sectors has been done with the following extraction of results: the **wood factory manager**, which also includes **furniture factory manager** competences, is the occupation profile that In4wood identifies as closer to the selected national profiles, especially in the Spanish case, which are focusing on **coordination and management**.

While for the Italian case, the focus is much more on Technical profiles related to design, industrial design, process, production, communication and marketing. The closest EU profiles identified in this direction are **manufacturing manager and furniture designer.**

For the UK, there are currently no furniture industry specific professional or vocational qualifications relating to the management senior production technician. Usually furniture managers or technicians will complete a 'craft' qualification and then add to this, a generic qualification covering management, technical design or some other advanced specialism – but these are not specifically focused on the furniture industry. The furniture industry is currently developing a new range of advanced and higher-technical qualifications which will be available in late 2019 at the earliest. Like Germany, the UK has until now, had a strong focus on craft production

In the German case, with a stronger focus on wood processing and woodworking factories, the national profiles selected, woodworking mechanic, wood processing mechanic, carpenter and upholsterer are closer to **wood production supervisor** and the **same carpenter and upholsterer**.

Here follows the related competences for each European occupation profile

EUROPEAN OCCUPATION	SKILLS AND COMPETENCES	CORRESPONDING NATIONAL REFERENCE PROFILE

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

WOOD FACTORY MANAGER: Wood factory managers realise planning, commercial and advisory tasks of wood factory and timber trade. They also manage purchasing, sales, customer service and marketing of wood and wood products.	adhere to organisational guidelines advise customers on wood products analyse production processes for improvement carry out purchasing operations in the timber business create manufacturing guidelines define manufacturing quality criteria delegate activities develop manufacturing policies ensure equipment availability follow company standards liaise with managers manage budgets manage factory operations manage production systems manage staff manage supplies meet deadlines oversee quality control plan health and safety procedures sell processed timber in a commercial environment strive for company growth study prices of wood products	SPAIN: Organisation and production management in the furniture and carpentry industries SPAIN: Manufacturing planning and management in wood and cork industries
MANUFACTURING MANAGER: Manufacturing managers plan, oversee and direct the manufacturing process in an organisation. They ensure products and services are efficiently produced within the timeframe and budget given.	adhere to organisational guidelines create manufacturing guidelines define manufacturing quality criteria develop manufacturing policies follow company standards manage budgets manage staff manage supplies meet deadlines plan health and safety procedures strive for company growth	SPAIN: Organisation and production management in the furniture and carpentry industries SPAIN: Manufacturing planning and management in wood and cork industries ITALY: Senior Technician for Process, Product, Communication and Marketing Technician for the Furniture Industry
FURNITURE DESIGNER: Furniture designers work on items of furniture and related products. They design the product and are involved in its production as craftsmen and designers or makers. The conception of furniture combines innovative design, functional requirements and aesthetic appeal.	adapt to new design materials attend design meetings consult with design team design original furniture develop design concept gather reference materials for artwork monitor art scene developments monitor exhibition designs monitor sociological trends monitor textile manufacturing developments present detailed design proposals transfer designs	ITALY: Senior Technician for Design and Industrial Design UK: Furniture Design Technician
WOOD PRODUCTION SUPERVISOR: Wood production supervisors monitor processes involved in the conversion of felled trees into usable lumber. They follow the production process and make quick decisions to resolve problems. They ensure that production targets, such as quantity and quality of	analyse the need for technical resources communicate problems to senior colleagues coordinate communication within a team create solutions to problems ensure finished product meet requirements evaluate employees work follow production schedule keep records of work progress liaise with managers manage resources meet productivity targets	GERMANY: wood processing mechanic, woodworking mechanic

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

products, timeliness and cost-effectiveness, can be achieved.	oversee production requirements report on production results wear appropriate protective gear	
UPHOLSTERER: Upholsterers provide objects such as furniture, panels, orthopaedic devices, fixtures or vehicle parts with padding or soft covering. They can install, repair or replace the upholstery of objects with materials such as fabrics, leather, suede or cotton. Upholsterers install the webbings and springs necessary to cover the material.	create patterns for textile products fasten components install spring suspension perform upholstery repair provide customized upholstery sew pieces of fabric sew textile-based articles	GERMANY: Upholsterer UK: Upholster
CARPENTER: Carpenters cut, shape and assemble wooden elements for the construction of buildings and other structures. They also use materials such as plastic and metal in their creations. Carpenters create the wooden frames to support wood framed buildings.	apply wood finishes clean wood surface create smooth wood surface create wood joints follow health and safety procedures in construction identify wood warp inspect construction supplies install construction profiles install wood elements in structures install wood hardware interpret 2D plans interpret 3D plans join wood elements keep sawing equipment in good condition keep track of wooden elements snap chalk line sort waste transport construction supplies use measurement instruments use safety equipment in construction work ergonomically	GERMAY: Carpenter UK: Carpenter

Table 20: European Occupation Profiles related to In4Wood ant their competences.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

8. Conclusions

Analysing the answers obtained from all tasks performed in this work package 1 from those respondents who have already experienced the implementation of I4.0 KETs in furniture industries (furniture manufacturers and KET experts), the following conclusions can be extracted:

- **The level of implementation of each one of the KETs addressed in the countries analysed depends on the characteristics of the sector at national level**: while in Germany, mainly represented by medium or big sized companies with specific needs related to a mass production (technologies applied to the production process and also maintenance and sales levels); in Spain and UK the approach to Industry 4.0 KETs is more related to the manufacturing process including logistics and delivery; in Italy, where the production process in the whole business of the furniture manufacturing sector counts a small % (most of companies are small in size and are concentrated on finishing instead of mass production) compared to the importance of other processes such as design, prototyping, sales, marketing
- The vast majority of the **furniture manufacturers and VET experts agree** that the **biggest barrier found during the implementation of I4.0 technologies has been the lack of knowledge and skills among staff**, along with an **insufficient training** in the topic and the **high cost of said technologies**, while respondents from VET/HE highlight the **difficulties in understanding the benefits** deriving from their application as a barrier too. This couple with the fact that most of the KETs experts who participated in the survey cite that they **have not been involved in training programmes addressing KETs**. This reinforces the fact that the **close relation between Industry 4.0 competences and the production world** with a **specific focus to the furniture manufacturing** sector has **not yet been built in national or regional context**. While other more technological sectors, have already been approached by specific professional training programmes on I4.0 KETs.

- Being an evident opportunity for their businesses, **there is a general interest in all I4.0 KETs among furniture experts**, paying special attention to Additive Manufacturing, Augmented Reality, System Integration and Internet of Things. These four KETs are also the most interesting for the furniture sector by VET/HE communities, following with Cloud computing, Cyber security and big data, and preferring Robotics, System Integration Cyber Security and Additive manufacturing for new training to support employers on I4.0.

- **Blended learning is considered as the most suitable type of training** by both furniture manufacturers and representatives from the VET/HE community. Onsite learning is also well valued by furniture manufacturers, and **online training is considered suitable** for some members of the VET/HE community. The preferred course extension ranges from 30 to 60 hours.
- Results evidence **a lack of digital business strategy among furniture industries**, specially SMEs, showing also a **poor involvement in the Internet of Things and in the use of cloud solutions**. However, these results contrast with the interest of these companies in collaborating with new

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

partners in the coming years dealing with digital technologies and cloud platforms, which foresee a relevant change in the traditional structure of furniture SMEs and their manufacturing philosophy, and thus, **requiring new skills among their workers**.

- Roughly half of the participants stated that the **workforce** in their company **would accept a more automated workplace** at a medium level, being this very significant given the strong craftsman character of the sector.

- Participants from the **VET/HE community** state that all the **indicated KETs are present within their study/work/research programmes**, but **not in very high levels of competence**, being System Integration, IoT, Autonomous Robots, Cloud Computing and Simulation the KETs that more attention are shown.

- A relevant number of **respondents from the VET/HE** community declare having **some knowledge in the application of these technologies** in other sectors and environments, such as the automotive industry, home automation or assisted living. However, **the vast majority admit they do not know how KETs could be applied in furniture and woodworking industries**, which evidences a **gap in current training programmes** promoting the implementation of new technologies in traditional manufacturing sectors. Other sectors (automotive, IT for instance) are targeted by training programmes related to Industry 4.0 much more than the furniture and woodworking sectors: training institutions and training agencies are called to put in action focused programmes in order to spread KETs related knowledge even in traditional manufacturing sectors, where the need of training processes is much higher.

- Participants declared that **in the next 5 years IoT and IIoT are becoming strategic,** especially for using data and sensors to make decisions and interact considering that they are mainly using data sources and sensors for the acquisition of data in a less structured way.

- In spite of the fact that respondents relate KETs within some specific sectors and application (industry, public administration, Logistics, management of processes in general, home automation, automotive, smart cities and smart environments, energy, IT, etc.), most of the participants believe that:
  - Implementing Information Technologies to the production process of furniture companies can bring higher productivity of both humans and machines thanks to their interaction and a reduction of mistakes and prototyping costs.
  - Robotics solution may bring efficiency in the furniture and woodworking industries, especially when it comes to Productivity, product quality, waste reduction and safety, making their future work smarter, supporting in problem solving, making decision process more accurate and simplifying all processes in general.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union

- Several advanced solutions and European technology providers have been identified during the deep State of the Art analysis performed during T.1.6, where the KETs addressed in this study are implemented for the benefit of the furniture production.

- During this Work Package, the first steps of harmonisation of the future training content have been carried out:
  - The national qualification levels of the four countries have been analysed and compared with the European Qualification Framework.

EQF	ITALY		SPAIN		GERMANY		UK	
	NQF	Qualifications	CNCP	Acreditación	DQR	Qualifications	NQF	Qualifications
Level 1	Level 1	lower secondary school leaving diploma	Level 1	Operator	Level 1	Vocational training preparation	Level 1	Entry level certificates [Basic skills]
Level 2	Level 2	compulsory education certificate			Level 2	Vocational training preparation, full time vocational school	Level 2	Traineeships, GCSE grades D to F, NVQ level 2
Level 3	Level 3	professional operator certificate	Level 2	Medium-level Technician	Level 3	DUAL VET (2 years)	Level 2	Apprenticeship, BTEC First Diploma, NVQ Level 3, GCSE grades A to C
Level 4	Level 4	professional technician diploma, upper secondary education diploma (including vocational schools)			Level 4	DUAL VET (3 years)	Level 4	Advanced Apprenticeship, Vocational A Level, AS/A2 level, NVQ level 4, Certificate in Higher Education
Level 5	Level 5	higher technical education diploma	Level 3	Higher-level Technician	Level 5	IT specialist	Level 5	Higher Apprenticeship, HNC, Foundation Degree, Diploma in Higher Education, NVQ level 5
Level 6	Level 6	Bachelor degree	Nivel 4	Degree	Level 6	Bachelor degree	Level 6	Higher Apprenticeship, Bachelor degree
Level 7	Level 7	Master	Nivel 5	Master Degree	Level 7	Master	Level 7	Masters Degree, postgraduate certificates and diplomas
Level 8	Level 8	Doctor	Sin definir	PhD	Level 8	Doctor	Level 8	Doctorates

Table 21: NQF versus EQF

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

- The desk research performed within each national body and ESCO competences allowed to analyse the professional qualifications and competences related to furniture and woodworking in each country and in Europe, allowing the identification of those qualifications related to In4Wood and their target users, detailing all the skills and competences these qualifications are addressing.
- During all this analysis, partners have made the first contacts with the national contact points for the European Tools EQF, ECVET and EQAVET.

Partners contributing to the results of this first Work Package are VET providers and Sector experts from Spain, Italy, Germany and UK, with a total production of furniture of 45€billion (more than half the total share of EU28). The research performed has enabled the analysis of the skills needs in the furniture and woodworking industries regarding the main Key Enabling Technologies that Industry 4.0 involves. And thus, achieving the first milestone of the project: *Definition of Skills Needs.*

This analysis will be further used by the VET providers for the design of the most suitable training paths for the identified target users as well as for profiling the Joint Curriculum Vitae on Industry 4.0 expertise in the wood and furniture manufacturing sector.

Selected National Profiles are summarized here down as:

SPAIN
2 main Profiles deriving from the Spanish qualification profile framework have been selected has the most appropriate in relation to In4wood focus:

- Organisation and production management in the furniture and carpentry industries
- Manufacturing planning and management in wood and cork industries

ITALY
2 main Profiles deriving from the Italian qualification profile framework have been selected has the most appropriate in relation to In4wood focus:

- Senior Technician for Design and Industrial Design
- Senior Technician for Process, Product, Communication and Marketing Technician for the Furniture Industry

UK
There are no current craft roles from the UK its National Qualification Framework, which can be considered as the most appropriate to select in relation to In4wood focus. However there are two qualifications, which offer some alignment:

- Furniture Manufacturer (Carpenter) and
- Upholsterer

But the activity from this In4wood project will feed directly into the process of supporting the development of 3 new Technical Profiles for the UK (Furniture Production Manager, Furniture Product Developer and Furniture Design Technician).

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA
Funded by the Erasmus+ Programme of the European Union

GERMANY

4 main Profiles deriving from the German qualification profile framework have been selected has the most appropriate in relation to In4wood focus:

- Woodworking Mechanic
- Wood processing Mechanic
- Carpenter
- Upholsterer

They are placed generally at levels 3-4-5 in relation to EQF levels and they will be those profiles addressed by In4wood in terms of implementation of competences and skills: generally it is evident that National Profiles, even if they are revised periodically, are in all countries related to traditional competences and rarely take into account updated needs of the labour market such as competences and skills related Industry 4.0 technologies. In this phase of implementation In4wood will have a key role in revising profiles and opening a debate in each country by involving national contact points for the analysis and eventual approval of the integrated profiles that In4wood will generate.

ESCO analysis:

The harmonisation of selected national profiles with ESCO occupations demonstrate the very different national situations taken as starting point. From the managerial profiles selected in Spain (which for instance do not exist in Italy or the UK related to the furniture sector) to the senior technicians of Italy, down to specialised workers in both Germany and the UK like upholsterers and carpenters, the situation described tells again about differences in the sector of furniture and wood working in the 4 countries.

This will lead to a possible integration of I4.0 related competences at various levels of occupation of the sector which are considered by each country as the most strategic profiles for the introduction of those skills in the furniture and woodworking sector.

This project has been funded by the action Sector Skills Alliances in Vocational Education and Training from the Erasmus+ Programme.
Project Number 575853-EPP-1-2016-ES-EPPKA2-SSA

Funded by the Erasmus+ Programme of the European Union