DIGIT-FUR

IMPACTS OF THE DIGITAL TRANSFORMATION IN THE WOOD FURNITURE INDUSTRY

Report on the Furniture Sector Status

LEAD PARTNER:

cenfim Home & Contract Furnishings

Furnishing Cluster and Innovation Hub

ASSOCIATED ORGANIZATIONS:

European Federation of Building and Woodworkers

European Federation of Building and Woodworkers

UEA

European Furniture Manufacturers Federation

EFIC European Furniture Industries Confederation

European Furniture Manufacturers Federation

With financial support from the European Union

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The DIGIT-FUR Project

The **DIGIT-FUR** project http://www.digit-fur.eu (Impacts of the digital transformation in the wood furniture industry) will focus on the changes caused by the **Industrial Digitization** on the **European wood furniture sector in 2025**. It is a two years project (2017-2019) funded by EU trough the call Support for Social Dialogue. The project main deliveries will provide a better understanding of the possible **scenario of the sector due to digitization in 2025** and the effect of this process on sector **jobs** in terms of changes in occupations, **health and safety risks** at work and new **skills** needed and thus support the social dialogue during next years.

The **partners** of the DIGIT-FUR project are: **CENFIM** - Furnishings Cluster and Innovation Hub (Lead Partner); **EFBWW** - European Federation of Building and Woodworkers; **UEA** - European Furniture Manufacturers Federation and **EFIC** - European Furniture Industries Confederation.

Purpose of this "Report on the Furniture Sector Status"

This "**Report on the Furniture Sector Status**" provides you some basic information and data about the current situation of the sector. The aim of this document is to be used as **reference material** by the more than 50 professionals who will participate in the survey "Forecasting the Furniture sector in 2025". This report summarizes the basic and key aspects to better understand the current situation and current trends of the wood furniture industry, which are: scope of the sector; processes and technologies; occupations and employment; VET in the furniture sector; risks & hazards in the sector and key drivers for the digital transformation of the sector.

The survey "Forecasting the Furniture sector in 2025"

The survey is the first step of the project research aiming to **Forecast the European Furniture Sector in 2025**. It will involve more than 50 professionals, experts in different fields: furniture sector, industrial digitization, Health & Safety at work, economy and VET systems. The answers collected will be analyzed and interpreted and the results will be presented during the project **workshop** that will take place in **Brussels on the 25th of October**. The results will be used as basis for the Workshop discussion and will **serve to agree on the most probable Furniture Scenario in 2025 in Europe**.

These results will be used in the next steps as key inputs to understand the impact and the effects of the **DIGITIZATION** process on the Furniture sector **jobs** in terms of changes in occupations, **health and safety risks at work** and new **skills** needs and thus support the **social dialogue** during next years.

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1.- Defining the sector

1.1. Scope of the furniture sector in the DGIT-FUR project

The **scope** of the "**Furniture Sector**" targeted by the DIGIT-FUR project is the following:

- From an **economic** point of view, the project scope includes the following activities:

  MANUFACTURE OF FURNITURE (NACE Rev. 2: **31.0**)

  31.01 Manufacture of office and shop furniture: It includes the manufacture of furniture of any kind, any material (except stone, concrete or ceramic) for any place and various purposes.
  - chairs and seats for offices, workrooms, hotels, restaurants and public premises
  - chairs and seats for theatres, cinemas and the like
  - special furniture for shops: counters, display cases, shelves, etc.
  - office furniture
  - laboratory benches, stools, and other laboratory seating, laboratory furniture
  - furniture for churches, schools, restaurants
  - decorative restaurant carts, such as a desert cart, food wagons

  31.02 Manufacture of kitchen furniture

  31.09 Manufacture of other furniture
  - sofas, sofa beds and sofa sets
  - garden chairs and seats
  - furniture for bedrooms, living rooms, gardens etc.
  - cabinets for sewing machines, televisions etc.
  - finishing such as upholstery of chairs and seats
  - finishing of furniture such as spraying, painting, French polishing and upholstering

  The activity "31.03 Manufacture of mattresses" is not part of the Project scope.

- From the point of view of the **manufacturing processes**, the DIGIT-FUR project focus the attention on the production of wood furniture. Which represents the 57% of the furniture production within the EU28 (CSIL, year 2010). Wood must be understood as solid wood and semi-finished wood (laminated, particle, plywood, melamine or fibre boards, among others).
- From the point of view of the **value chain**, the project takes into consideration the processes usually developed by wood furniture manufacturers: supplying, design, production and distribution (Note: see the section 1.3 focusing on the "value chain in wood furniture manufacturing"). Processes in the first steps of the value chain (e.g. raw materials production) or in the last steps (e.g. retailing) are out of the scope of the DIGIT-FUR project.
- From the point of view of **occupations**, DIGIT-FUR will focus on those jobs specific of the sector (wood furniture manufacture) and not on those in common with manufacturing sectors (e.g. administrative support staff, accounting & finance staff, etc.). The following occupations will be taken into consideration by the DIGIT-FUR project: managers, ICT professionals, designers, production managers, sales & marketing, supply chain managers, plant and machinery maintenance and repair staff, skilled handicraft workers, machine operators, labourers, etc.

1.2. Structural characteristics of the furniture sector in the EU

1.2.1.- Furniture production

The 23% of the furniture world production takes place in the EU28, 83,470 € million of a total of 360,862 € million (CSIL, 2012). The main manufacturing countries are Germany (17,738 € million), Italy (15,950 € million), Poland (8,323 € million) and France (7,929 € million), followed by United Kingdom, Spain, Sweden, Denmark, Netherlands and Austria. Altogether, the first four countries produce the 14% of the furniture world manufacturing and the 60% of the EU28 production. Since 2013, there is a constant increase of 3% of the EU annual production.

Table 3.2.- Production of furniture in EU28 (Source: EUROSTAT) / - Units: Index 2010 = 100 -

	YEAR / Unit: Index 2010 = 100						
Sector and sub-sectors	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Manufacture of furniture (31.0)	**[1]100**	**102.2**	**96.4**	**92.6**	**94.9**	**97.6**	**101.0**
Manufacture of office and shop furniture (31.01)	[2]100	113.1	97.1	92.3	92.9	95.8	97.0
Manufacture of kitchen furniture (31.02)	[3]100	94.9	92.5	92.4	94.2	97.5	104.1
Manufacture of other furniture (31.09)	[4]100	97.9	93.2	85.7	86.2	86.8	88.1

1 = 83,470 € million / 2 = 15,860 € million (19%) / 3 = 10,017 € million (12%) / 4 = 46,743 € million (56%)

Western Europe provides 80% of EU28 furniture production (10% more than a decade ago), losing relative importance compared to Central Eastern Europe, whose production is at present 50% higher than a decade ago, with fast growth in Poland, Romania, Lithuania and Slovakia (CSIL, 2011).

The European market stock up on furniture produced for the 85% within the EU28 and the other 15% is imported from outside (CSIL, 2012). The trade balance is positive, as the EU28 furniture export is higher than import for an amount of 5.500 € millions in 2016 (EUROSTAT, 2016).

1.2.2.- Productivity and labour cost

The EU furniture manufacturing sector accounted for 3.5% of the manufacturing in EU workforce and 1.9% of the manufacturing value added, thereby indicating that the sector was characterized by a low level of apparent labour productivity. The labour productivity of the EU furniture manufacturing sector was 28,300 €/ employee, below the manufacturing average of 52,000 €/employee. It was accompanied by low average personnel costs which were equal to 23,700/employee, around 1/3 below the 35,800 €/employee for manufacturing as a whole (EUROSTAT, 2010).

Regarding the cost structure of furniture production in EU28, purchases of goods and services accounted for 75% of the total production value in the EU28 furniture industry and personnel costs in the furniture manufacturing sector accounted for around 24% of the production value (CSIL, 2011).

The workforce in the furniture sector in EU28 is predominantly male, accounting for 70%. Workers under 40 years make up the 48% and those over 55 years represent the 15%. Most workers (50%) have medium education level and being the employees with a low education level moderate (30%).

1.2.3.- Company size

The EU28 furniture sector (NACE 31.0) is predominantly made of SMEs, with around 88% being micro enterprises (fewer than 10 employees) and another 10% of companies being small (10 to 49 persons employed). Medium-sized companies (from 50 to 249 persons employed) account for 2%. These companies altogether account for over 75% of total sector production (CSIL, 2010). However, while large companies (more than 250 persons employed) may account for less than 0.5% of total enterprises they generate the 25% of the total value of furniture produced in EU28 (CSIL, 2010). El cierre constante de empresas que ha tenido lugar durante los últimos años parece aplanarse.

Table 3.2.- Number of furniture enterprises by size in EU28 (Source: EUROSTAT)

	YEAR / number of enterprises in EU28			
Enterpise size:	**2011**	**2012**	**2013**	**2014**
from 0 to 9 persons employed	110,000	108,157	104,606	104,885
from 10 to 19 persons employed	8,589	7,933	7,900	7,675
from 20 to 49 persons employed	4,839	4,680	4,478	4,282
from 50 to 249 persons employed	2,756	2,590	2,510	2,412
250 persons employed or more	425	420	410	404
TOTAL:	**126,000**	**123,774**	**119,921**	**119,656**

1.3.- Value chain in wood furniture manufacturing

1.3.1.- Design

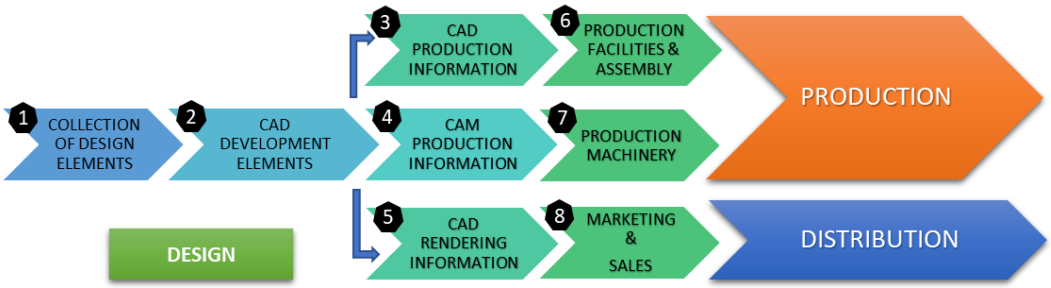

Figure 1.1.- Design process

1. Companies currently collect information about the products to be produced mainly from distributors. Only big companies have a structured marketing department with their own market research.
2. Companies work on product development using software like AutoCAD and other software mainly in 2D. The designing process, even in 3D, does not always provide the information needed for manufacturing.
3. From the CAD software all the companies obtain information about measures and mockups to be interpreted by production departments. Generally, 2D printed drawings of the components are obtained.
4. Due to the diversity of numerical controls and protocols used by the machine manufacturers, few companies are able to set up CAM machines using directly CAD drawings.
5. Moving from physical photography to photo-quality rendering.
6. More and more CAD information is being used in real time for supporting production and assembly operations.
7. Machine manufacturers are improving machine control software increasing possibilities to import various types of CAD files.
8. Marketing and sales departments are increasingly employing photo rendering for the fast generation of catalogues and other sales tools.

1.3.2.- Distribution

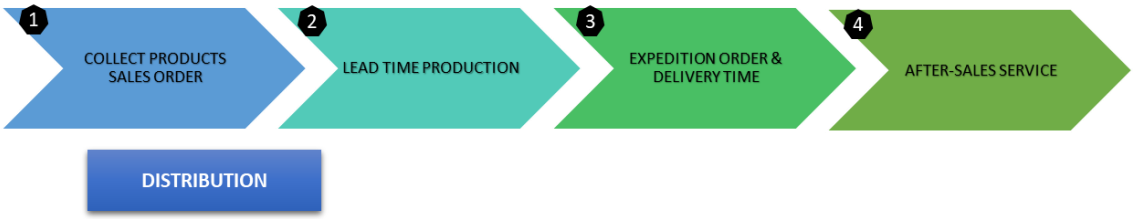

Figure 1.2.- Distribution process

1. The increasing products customizations required by customers represent a challenge for the orders collection systems, which can play a key difference among small and large enterprises.
2. The reduction of the lead-time is today the key factor to ensure the survival of companies in some market segments.
3. The way in which orders are grouped and delivered defines the delivery time and it differentiates the companies oriented to the final customer service from those working through distributors.
4. Few companies still have direct contacts with the final customer. Usually, they are companies of big dimensions, with brand strategies and direct delivery of KIT type products (DIY, FLAT PACK).

2.- Processes and technologies in wood furniture manufacturing

2.1.- Processes

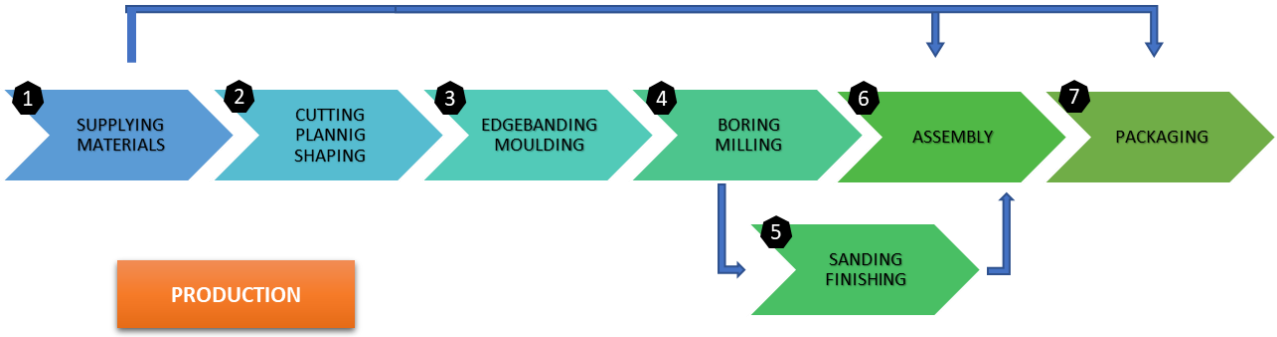

Figure 2.1.- Production process

1. The increasingly complex management of the external suppliers and of their products represents a big difference among small and large enterprises for purchasing logistics
2. This first machining stage serves to give the right dimensions to the parts that will make up the final product.
3. The second machining stage is used to finish the edges of the pieces, either by applying a band, which can be of different materials, or by moulding the piece with a milling cutter in the case of solid wood.
4. The third production stage and usually the last, serves for structural and aesthetic finishing, which will also allow the assembling of the product components. Moreover, it provides the final image of some elements that allow differentiating among products with the same function.
5. Some articles and components require finishing processes using varnish or paint. These processes require applying several layers with intermediate sanding.
6. After the completion of the components, there is the assembling process. Not all the items are assembled. Sometimes they remain disassembled because of their size or weight.
7. The final process is the packaging. It is intended to protect the set of components of the product (or the product itself) during the transportation to the distributor or to the final customer. It is not always used for advertising or marketing purposes.

2.2.- Operations and technologies

Wood used as raw material in wood manufacturing sector facilities can be:
• Solid wood.
• Semi-finished wood: laminated, particle, plywood, melamine or fibre boards, among others.
Other raw materials used in woodworking facilities are:
• Chemical products: glues, sealers, varnishes, dyes, lacquers, paints, solvents and other finishing products.
• Leather, fabric, fibres and organic foams (e.g. polyurethane) for upholstering products.
• Packaging materials: cardboard boxes, plastic for shrink wrapping and cardboard or plastic corner units.
• Metal elements (ironwork), such as screws, hinges, locks and rivets.

Cutting and sectioning of the board to the required dimensions, by means of circular or band saws, planners or thickness planners. When the particleboard is not veneered, this must be veneered according to the following steps:
- Cutting of veneers (by means of guillotines).
- Joining together of veneers (by means of a sewing machine).
- Gluing (thermosetting adhesives of the urea–formaldehyde resins type) by means of roller gluing machines.
- Pressing: Bonding together of veneer and board through application of pressure and heat.

Piece machining by means of individual or complex machines performing several operations in continuous processes like profilers, bevellers, moulders or edge banding machines.

The parts are machined through CNC machines. At present, the use of this type of machines has been extended as they substituted the consecutive operations made by machines such as millers, tenoners, lathes and others that are more dangerous for operators.

Through sanding and polishing, the surfaces of machined pieces are prepared for the following surface finishing processes. These operations are carried out by abrasive machines, mainly sanders and polishers.
Once the surface qualities required are achieved, then the varnishing and painting operations are carried-out. One first layer of varnish or paint (bottom) is applied on the dry piece, then it is left to dry again and it is sanded and painted again (finishing). Paints and varnishes are applied either inside varnishing lines for flat surfaces (the pieces undergo a series of operations like: sanding, polishing, and application of putties, paints and varnishes) or gun spraying for the rest of pieces (paint booths). Intermediate drying operations are performed inside the varnishing line by means of infrared and/or ultraviolet lamps.

Even though new manufacturing systems (like Lean Production) offer many advantages and improvements in productivity, these systems have not been widely implemented in the furniture industry. Probably, this is because the conversion to a new system is a major challenging project requiring a strong and sustained commitment by the whole company, from the management to the last employee.

Keep track of the finished goods that are returned because of damages during on-site handling or in the following distribution phases is an important job. Some measures are usually taken to minimise damage rates:
• Training staff in manual handling techniques to minimise damage
• Minimising rough surfaces, sharp corners on benches, etc. in process areas, to minimise goods damages while being manufactured and handled.
• Storing correctly the packaging so that the product is not soiled and product damage (such as scratching due to grit and dirt) is avoided
• During the transport: leaving fasteners unlocked to prevent loosening (e.g. those on wardrobe doors); using strings to tie the items such as drawers; strapping down or tying items up within delivery vans/lorries; and not overloading delivery vans/lorries
• Using corner protection packaging which can reduce damages

3.- Occupations and employment in the furniture sector

3.1.- Employment in furniture sector in Europe and its main countries

In 2014, the employment rate of the population aged 15 to 64 in the EU-28, as evidenced by the EU workforce survey, was 64.9%. In 2008 it reached its maximum value (65.7%), then dropped in the following years to 64.1% in 2010. Manufacturing occupy for 15% of employees in the European Union, reaching the highest levels in countries such as the Czech Republic (25%), Slovenia (21%) and Germany (19%).

As far as furniture sector is concerned (NACE 31), we can say that total employment in Europe (EU 28) is almost one million (955,521), thus covering about 3% of European manufacturing workers. The top 5 countries by number of employees in the Furniture sector are: Poland, Germany, Italy, United Kingdom, Romania.

Table 3.1.- Manufacture of furniture, Number of persons employed (Source: EUROSTAT)

FURNITURE	Persons employed in 2014	% Persons employed furniture / Persons employed manufacturing
European Union (28 countries)	955,521	3%
Poland	161,187	7%
Germany	142,679	2%
Italy	136,185	4%
United Kingdom	70,940	3%
Romania	61,504	5%

As can be noticed the high number of employees in the Furniture sector, it does not always involve a high percentage of employees compared to the Manufacturing sector. If these are the top 5 countries by number of employees in the Furniture sector, ranking changes if we look at the incidence that this sector has on the number of manufacturing employees. According to this standard in the top 5 positions we find: Lithuania, Estonia, Bosnia Herzegovina, Poland and Latvia, with very high percentages and well above the European average, as in the case of Lithuania 13%.

Table 3.2.- Main countries in Furniture sector, % persons employed related with manufacturing (Source: EUROSTAT 2014)

MAIN COUNTRIES	% Persons employed furniture / Persons employed manufacturing
European Union (28 countries)	3%
Lithuania	13%
Estonia	7%
Bosnia and Herzegovina	7%
Poland	7%
Latvia	5%

Focusing our attention on the top 5 countries by the number of employees dedicated to production in the Furniture sector, we can emphasize how the weight this sector has in each country's production is around the European average, and not particularly relevant. Of course, it is important to remember how this sector is not large and numerically important as others that constitute the manufacturing sector, but it is still interesting to see how different production systems in the European countries have developed and evolved over time.

3.2.- Employment by firms size

Looking at the trend of employees from 2012 to 2014 and their distribution in the various categories of companies in Manufacturing, it can be seen that most employees working in this sector work in large companies with more than 250 employees. This category has been growing, at the expense of medium-sized businesses, to a slight decline. Slight increase also for small firms. Same trend for large companies also in Furniture, which saw a strong growth since 2012 at the expense of medium and small businesses. There is therefore an important shift from small and medium-sized companies to large companies.

Figure 3.1.- Number of persons employed by firm size (Source: EUROSTAT)

Since 2012, the number of employees lost in the Furniture sector is around 40,000, of which about 16,000 are lost by small companies (0-9 employees). Since 2012, only large companies with a budget of +6,000 employees have grown. Always looking at the top 5 countries by the number of employees in the Furniture sector, we can see how each of them has developed a different production system and consequently a different distribution of the workforce.

If in Germany and the United Kingdom, in fact, we find a strong emphasis on large and medium-sized enterprises, in Italy the number of small businesses far exceeds all other categories. Poland is distinguished by the high concentration of very large companies, but also by a high percentage of very small companies. Overall, distribution in the European Union is more homogeneous, with a small number of employees in small companies that are close to that of large companies.

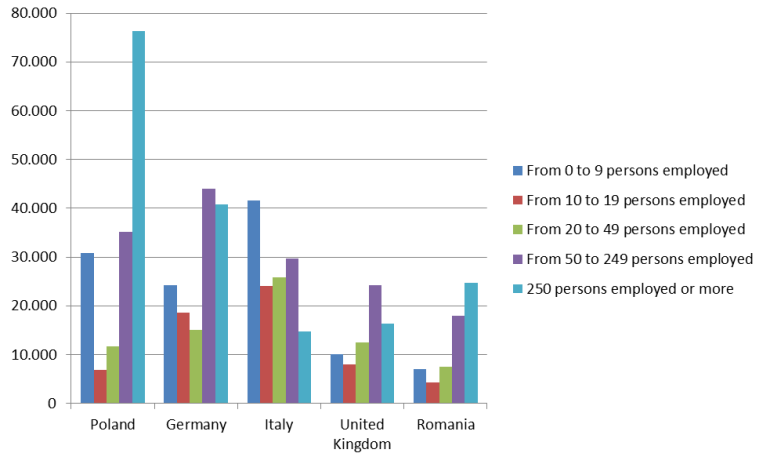

Figure 3.2.- Number of persons employed by firm size, main countries (Source: EUROSTAT)

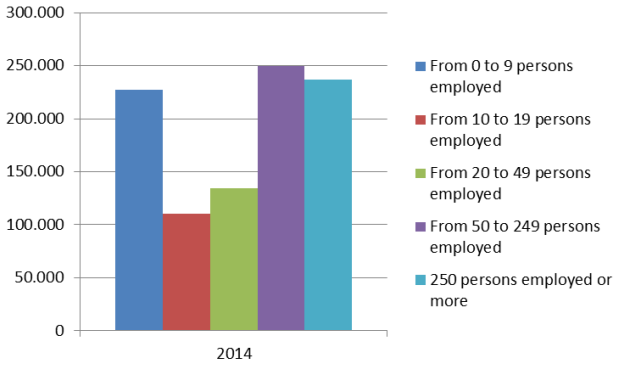

Figure 3.3.- Number of persons employed by firm size, UE 28 (Source: EUROSTAT)

3.3.- Employment by furniture sub-sectors

Analyzing Furniture sector specifically, we find that the sector employing more employee than others is identified with NACE code 31.09 (Manufacture of Other furniture) followed by Office and shop furniture (NACE 31.01), Kitchens (NACE 31.02) *& Mattresses (NACE 31.03) - excluded in DIGIT-FUR -.*

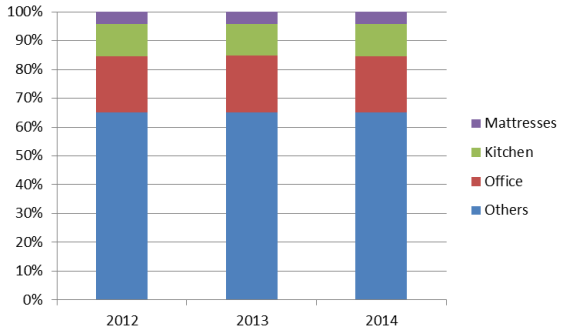

Figure 3.4.- Furniture sector composition, UE 28 (Source: EUROSTAT)

3.3.1.- Employment in manufacturing other furniture

The Manufacture of other furniture employs 623,007 people in 2014, confirming the most important Furniture sector by number of persons employed. In the first 5 positions we find Poland, Italy, Germany, Romania and Spain. Of these countries, only Poland and Germany have seen increasing the number of people employed in this sector from 2012 to 2014, while others have seen the number of employees destined for this type of production to fall.

Table 3.3.- Main countries in Manufacture of other furniture, num. persons employed (Source: EUROSTAT)

Manufacture of other furniture	2012	2013	2014
European Union (28 countries)	650,700	633,400	623,007
Poland	108,824	106,731	113,650
Italy	108,202	107,017	102,011
Germany	82,841	83,827	85,712
Romania	50,061	49,937	49,712
Spain	44,206	41,315	38,224

3.3.2.- Employment in manufacturing office and shop furniture

The second most representative sector Office and shop furniture. This category includes the manufacture of furniture of any kind, any material (except stone, concrete or ceramic) for any place and for various purposes.

Table 3.4.- Main countries in Office and shop furniture, number of persons employed (Source: EUROSTAT)

Office and shop furniture	2012	2013	2014
European Union (28 countries)	193,400	190,400	185,507
Germany	35,026	36,642	33,352
Poland	25,149	25,929	27,908
Italy	22,244	19,874	19,241
United Kingdom	20,640	19,973	16,891
France	16,359	16,454	16,179

In this case, Germany is the country with the largest workforce employed, although it has been downward in this sector since 2012. Poland, on the other hand, second country by the number of employees, has increased this number, while Italy has also fallen in this sector, remaining third. We have to underline the gap between Germany and Poland that is declining, with half their gap spread over three years. The United Kingdom is the country that loses most in terms of employees, while France remained almost constant in fifth place.

3.3.3.- Employment in manufacturing kitchen furniture

The Manufacture of kitchen furniture is the third by the number of employees, with about 106,000 dedicated employees. The top 5 countries in this case are Germany, Poland, UK, Italy and France. Even in this sector, the only countries that have seen the growth of the number of employees are Germany and Poland, followed by France, while all others have fallen from 2012 to 2014. In particular, Italy has decreased by about 1,000 units its own workforce dedicated to the kitchen sector since 2013.

Table 3.5.- Main countries in Manufacture of kitchen furniture, number of persons employed (Source: EUROSTAT)

Manufacture of kitchen furniture	2012	2013	2014
European Union (28 countries)	112,000	106,800	106,077
Germany	18,265	18,500	18,616
Poland	14,362	14,384	15,365
United Kingdom	14,883	15,289	14,204
Italy	12,312	11,470	10,578
France	8,659	6,986	7,973

3.4.- Aging of workforce

As for the characteristics of the workforce in Europe, it is to be said that despite the growth of the world population, there is a slowdown in population in Europe, leading the population to age year after year. The furniture industry also suffers from this aging and sees the workforce used to increase the average age over time. It can be noted that in 2014 about 38% of employees were between 25 and 39, while in 2005 it was 45%. In 2005 only 9% of the workforce exceeded 55 years, while in 2014 this figure increased by almost 15%.

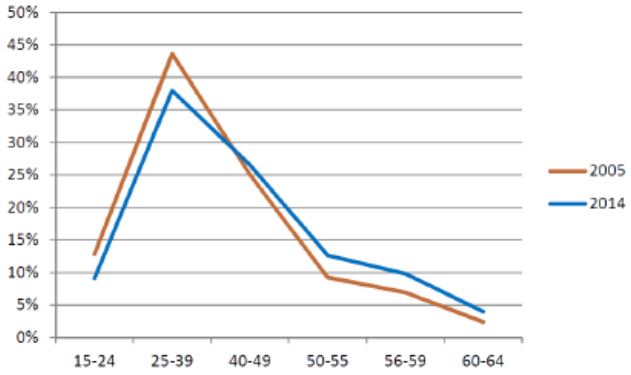

Figure 3.4.- Wood and Furniture demographic scenario (EU-28)
(Source: Woodual with data Eurostat and CEI -Bois)

According to the study that the Woodual Project carried out regarding the working environment of the Furniture sector, there are several reasons why the number of young people employed in this sector decreases. First of all, the decline in the number of children in the population, leading to the natural aging of the population and as a result of the workforce; Secondly, the lack of interest shown by young people towards qualified manual employment.

3.5.- Emergent competences in the furniture sector

With regard to the various competencies that the Furniture industry will ask in the future, much will depend on the different scenarios that will be verified in the coming years. According to the study by Woodual, the industry seems to be moving along some trends that affect the skills required by companies. The main trend is the **customization of products**. In all countries this aspect is recognized as crucial for the future development of furniture companies. Another very cited aspect is the **digitization of the sector and the great development of ICT within companies**.

These trends mean that companies in various European countries consider more or less important certain skills for the coming years. Below are the answers from the major European countries for the furniture sector, divided by skill types: manual, ICT, Design, Soft.

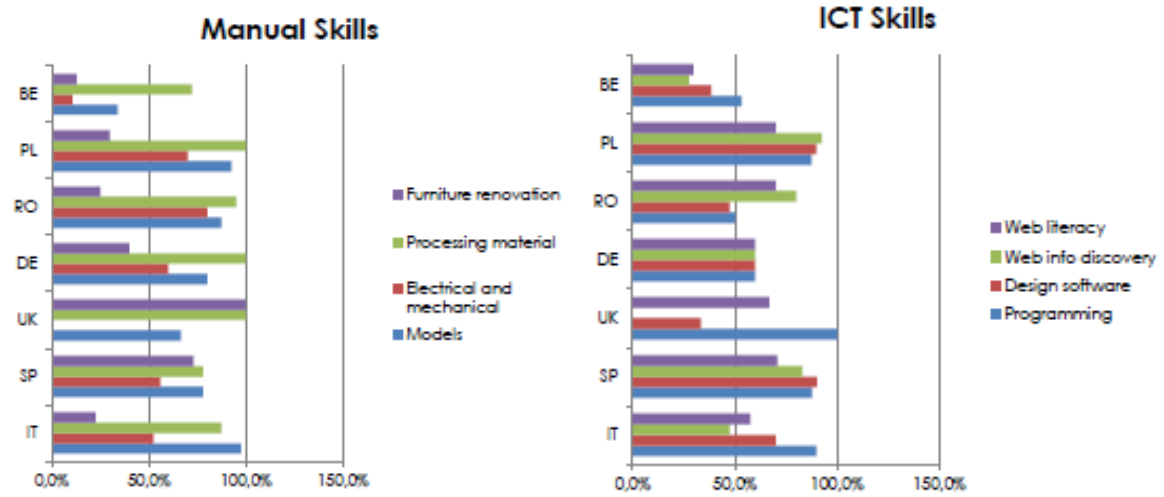

Figure 3.5.- Most important skills - Manual & ICT - in future in different countries (Source: Woodual)

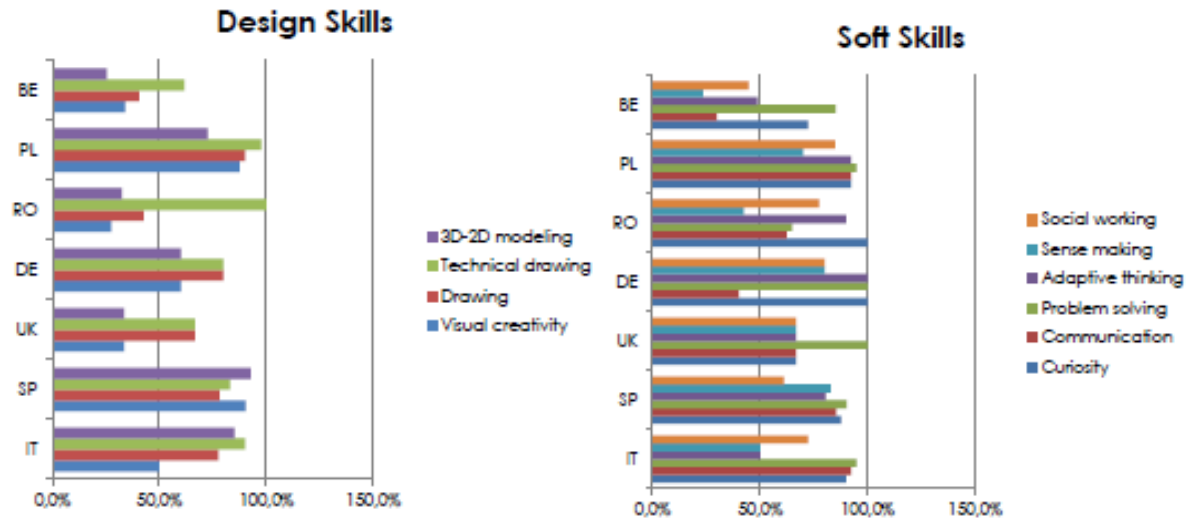

Figure 3.6.- Most important skills - Design & Soft - in future in different countries (Source: Woodual)

3.6.- Changes in job categories

The professional figures that will be born and will grow in the coming years in the furniture industry will be linked to these development trends. In particular, the "Furniture 2009. Future skills and jobs" study analyzes the future of the importance of different professional figures in companies depending on the various possible economic scenarios. One of the most interesting economic scenarios for the future of the Furniture industry is "Global customization", that is the increasingly acclaimed customization of products on a global scale. This scenario will be affected by some exogenous drivers: globalisation, outsourcing, international production networks and technology (including digitization of products and processes). In this context almost all professional figures will see an increase in the number of employees, with particular relevance for the top figures in decision-making and the figures related to product development and its global distribution, such as figures of industrial designers, product managers and supply chain managers. Below a summary table of the possible consequences for different corporate figures.

Table 3.6.- Main Relative volume changes by job category under Global Customisation scenario (Source: “Investing in the Future of Jobs and Skills“, European Commission)

JOB CATEGORY	Scenario: Global Customisation
Managers	I
ICT professionals	I
Industrial designers	I
Production managers	I
Accounting & Finance	M
Sales & Marketing	I
Supply chain managers	I
Administrative support staff	M
Plant and machinery maintenance and repair staff	I
Skilled handicraft workers	M/D
Machine operators	M/I
Labourers	D
Overall job change	M/I

D= decrease, I= increase, M=maintain. I/M indicates “slight increase to stabilization of work force expected.” Similarly M/D indicates “stabilization to slight decrease of work force expected”.

4.- VET in the furniture sector

Modernising VET to ensure its outcomes empower learners to find and maintain jobs and advance in their educational careers, has been the heart of EU cooperation for the last decade(s). In recent years, VET has (again) moved high up on the policy agenda (see further on the European Skills Agenda). With the European Qualification Framework (EQF) and the European Credit system for Vocational Education and Training, two tools were developed to compare, not the national VET-systems, but the learning outcomes from the different qualifications and educational pathways.

National VET systems are still widely different and it is almost impossible to compare these on a European level in a short and comprehensible report. Neither is it easy to understand the different (national and regional) frameworks, conditions and practices.

One thing that is in common of almost all EU countries, is that v**ocational educational pathways start around 15/16 years old and generally have a duration of 3 to 4 years**. Youngsters come out as skilled workers from 18 till 20 years, depending on the choice of the educational pathway and on the country/region. In some countries, VET starts already from 14 years old, in other countries, VET has a longer duration, in function of the chosen specialisation (*see also Spotlight on VET, Anniversary Edition by Cedefop (2015) and Country reports Spotlight on VET*).

In an international perspective, most EU countries, if not all of them, have the same difficulties concerning the attractiveness of VET and concerning the mismatch of the learning outcomes versus the demands from the labour market (Cedefop studies). VET for the furniture and woodworking sector encounters the same problems as other VET branches.

Through several previous projects related to the woodworking and furniture sector - in cooperation with EU[1] - the mismatch of skills in relation to the newest developments in technical and technological branches, lead to various actions to define these mismatch and to propose solutions (short/long term, institutional and practical, …). One of the main ideas is to compare the (professional) qualifications instead of the VET-system itself and to build up mutual recognition of the learning outcomes and qualifications.

To resolve these problems, the **European Skills Agenda** defined following actions:

- **Improving quality and relevance of skills formation**
  - Strengthening basis skills (skills guarantee).
  - Key competences and higher, **more complex skills** (Key Competences Framework).
  - Making **VET a first choice** (EQAVET – ECVET).
  - Focus on **digital skills** (digital skills and job coalition).

- **Making skills and qualifications more visible and comparable**
  - Improving transparency and comparability of qualifications (revision EQF).
  - Early profiling of migrants' skills and qualifications (skills profile tool for 3rd country nationals).

- **Improving skills intelligence and information for better career choices**
  - Better information for better choices (revision Europass Framework + tackle brain drain).
  - Boosting skills intelligence and cooperation in economic sectors: **Blueprint sectoral cooperation on skills** → automotive, maritime technology, space, defence, textile and tourism, but until now not for wood nor furniture sector.

[1] Such as Leonardo da Vinci-projects, Erasmus+KA1, Erasmus+KA2 and Erasmus+KA3-projects, …

- Better understanding the performance of graduates (Graduate Tracking).

The EU proposes following solutions, which could be helpful for strong and attractive VET

- **More work based learning (WBL) and business-education partnerships.**
- More support for learners' mobility (budget Erasmus+ is increasing).
- **More learning at the workplace.**
- **More opportunities to validate non-formal and informal learning.**
- Supporting teachers and trainers.
- Modernising higher education.

Following the EU strategy for new skills for new jobs, there is a need for a **Blueprint for sectoral cooperation on skills.** Unfortunately, there has been a political choice for six sectors (see above), but not (yet) for wood/furniture.

Summarised, we can state that we encounter **EU-wide the same problems in VET for wood and furniture sector:**

- A **lack of interest** shown by young people towards qualified manual employment, therefore **VET is not a first choice** (although more complex skills and digital skills) and there is an old-fashioned image of VET by youngsters AND their parent. **"Branding" of a modern and highly technological furniture sector is required**.

- There is a **qualitative skills shortage** for technical/professional profiles. The demand **for STEM-profiles (Science, Technology, Engineering and Mathematics) in the furniture industry**, thus for qualified people, exceeds the supply (*see also point 6.9*). High-tech manufacturing increasingly needs more highly skilled staff/STEM-profiles. More **international mobility** from youngsters and workers could help resolving this.

According to the study by the nine partner countries in the Woodual project (*see also point 3.5*), the **future skills** required by companies in furniture industry will be:

- **Manual skills**: for furniture renovation, processing material, electrical and mechanical skills, for handicraft modelling/prototyping;

- **ICT skills**: web literacy and web information gathering, for design software and for the programming of the production machinery/lines;

- **Design skills**: for 2D and 3D modelling, for technical drawing and sketching, for visual creativity;

- **Soft skills**: for social collaboration, sense making, for adaptive thinking, problem solving, communication and curiosity.

It goes without saying, that there is a need for a **better alignment of the education and training systems to** these **defined labour market needs**. Therefore cooperation of the educational (institutional) partners, social partners and sector organisations is a key factor to ensure an up-to-date VET-system. One of the proposed pathways to reach these objectives is dual learning or work-based learning (WBL), where business and education partnership emerge.

5.- Common risks and hazards in woodworking in the furniture industry

Woodworking in the furniture industry can be hazardous for workers. From the use of machinery and tools, handling heavy materials to exposure to dust, noise and chemicals - potentially harmful events can happen at any time. These events can affect the health of workers, for example causing them to suffer skin and respiratory diseases. They can cause injuries such as a loss of fingers or even death (OSHA, 1999).

5.1.- Hand and power tools

Machines used in woodworking are dangerous, particularly when used improperly or without proper safeguards. Woodworking machinery causes significantly more major injuries than machinery in any other industry. Workers operating woodworking equipment suffer the following common injuries: laceration, amputation and blindness. Circular saw benches are the machines that cause the most woodworking accidents. Many of these result in the amputation of fingers (HSE, no date).

5.2.- Flying or falling objects

Workers in the woodworking industry are also faced with potential accidents that can be caused by flying wood chips and some parts of machines that may get lose (safe and healthy life, 2017).

The centrifugal forces on an unbalanced cutter head can fling the knives from the tool and severely or fatally injure the workers. Using the wrong tool on a cutter head or using a tool at a higher speed than designated can cause tool breakage and dangerous flying parts. Wood parts may be caught by the blade and thrown back at the worker (kickbacks).

5.3.-Slips and trips and falls from heights

Slips, trips and falls are one of the most common causes of injuries for workers. Poor housekeeping and general untidiness are a major cause of slips and trips. Slips, trips and falls can happen because of: damaged flooring, spills and wood dust on the floor (wet or slippery floor), poor lighting, unsuitable footwear, unsafe use of ladders.

5.4.- Noise

The woodworking industry is one of the noisiest working environments. Exposure to loud noise can permanently damage hearing resulting in deafness or tinnitus (HSE, no date; Building and Wood Worker's International, 2006). Workers exposed to high noise levels, even for a short time, may experience temporary hearing loss. Continued exposure can result in permanent hearing loss. Noise may also have an adverse effect on other parts of the body and lead to stress-related disorders, such as nervousness, chronic fatigue, increased blood pressure, and impaired concentration and mental function.

5.5.- Vibration

Stationary and hand-held mobile machines may expose workers to high vibration levels. Hand-arm vibration syndrome is likely in any process where workers' hands are exposed to high vibration levels (e.g. from vibrating tools or workpieces). Effects include impaired blood circulation and damage to the nerves and muscles. The best known example is "vibration white finger" also called Raynaud's syndrome (Building and Wood Worker's International, 2006).

5.6.- Ergonomic hazards

Workers in the wood processing industry are exposed to heavy works (lifting of heavy loads, awkward postures, repetitive tasks). Problems may be associated with work-related low back pain and other musculoskeletal illnesses.

5.7.-Electrical hazards

Poorly maintained or broken machinery and electrical cables may pose workers at risk of electrocution. Using extension leads that are still wound on a reel may cause melting of the cable.

5.8.- Wood dust

Airborne wood dust from processes such as sanding and cutting are a potential health problem for workers. Breathing these particles may cause allergic respiratory symptoms, mucosal and non-allergic respiratory symptoms, and cancer (lung and nose) (Building and Wood Worker's International, 2006, OSHA, 1999; Furniturelink, 2016).

5.9.- Chemicals

A wide range of adhesives and coating agents are used in finishing wood products, such as solvents in paints, glues, varnishes and lacquers, and paint stripping chemicals. Many of these are hazardous to the health of workers. They may cause skin problems, brain damage, organ damage (such as liver and kidneys) reproductive problems, such as reduced fertility, damage to the unborn child, and mis-carriages. Chemicals can enter the body in three ways: through inhalation (breathing), ingestion (eating), or contact with the skin (OSHA, 1999, Work Safe Western Australia, no date).

5.10.- Fire / explosion

Transportation and storage of wood pellet and wood dust may put workers at risk of accidents. Woodworking facilities are inherently prone to fires and explosions mainly silos and filter systems. The main causes of fires in these areas are sparks generated by woodworking machines / tools. Electrical defects may also cause fire and explosions, and many of the solvents, lacquers, varnishes, and coatings used in the wood furniture industry are flammable (BGHW, no date).

5.11.- Confined spaces - silos

Entering in silos (confined spaces), e.g. for maintenance, removing chip congestions may put workers at risk to be suffocated (BGHW, no date).

5.12.- Risks related to digitization

Digitization poses new challenges for occupational health and safety. New types of workplaces, new processes, and new technologies may increase the safety and health of workers in human-friendly work systems. Robotics, for example, can make work that is physically demanding or monotonous easier or more efficient. Workers may be removed from hazardous environments, and sensors may automatically indicate whether a machine need maintenance and thus reduce the risk of machinery failure and incidents. But digitization may pose workers also at risks if aspects relevant to the protection of the workers are not taken into account in an early stage.

5.12.1.- Musculoskeletal disorders

Digitization changes the work environment and tasks. Manual work is substituted by working with computer workstations, even where a physical presence is required, such as in the wood furniture industry. Increased working on computer screens and poor ergonomic design of non-office visual display unit workplaces may lead to musculoskeletal disorders (MSDs) due to fixed body postures and physical inactivity at work (EU OSHA,2013a).

5.12.2.- Eye strain

An increasing number of workers spend their days in front of a computer screen or a mobile visual display. Eye problems through display include blurred or double vision, burning, itching, dryness and redness (EU-OSHA 2013a).

5.12.3.- Overload / underload, monotony

Increasing automation can lead to a lack of sufficient understanding of the new processes and technologies. This may lead to accidents due to someone doing something inappropriate or not knowing what to do when something goes wrong. Workers may also be exposed to time pressure and to an increased pace of work. Workers may face increasing workloads and task complexity, excessive working hours and constant reachability. This may lead to a higher likelihood of mistakes but also to ill health due to stress (EU-OSHA, 2017)

5.12.4.- Man-robot collaboration

Robots which work collaboratively with humans have started to have an impact on work. Fully autonomous robots have started to find work applications. However, complex interaction between humans and machines is limited. Workers expect the machine to communicate in the same way as they do and get frustrated when it does not (EU OSHA, 2009).

Digitization reduces the number of workers. Those remaining are increasingly isolated and have to act and communicate with the help of the new technology. They may feel isolated as personal relations are replaced by virtual contacts.

5.12.5.- Electromagnetic fields

The increased use of computer devices, new information and communication technology such as automation, ambient intelligence, and the use of robotics may expose workers to electromagnetic fields (EU OSHA, 2017).

5.12.6.- Other health risks

Digitization may put workers at risk of physical inactivity. This is associated with increased health risks such as coronary heart disease, overweight or obese, certain types of cancers and psychological disorders such as depression and anxiety (EU OSHA, 2013a).

Manipulation of safety guards and hacker attacks may change machine parameters and safety functions and thus jeopardize the safety and health of employees (scope online, 2016).

6.- Key drivers for the 2025 digital transformation of the furniture sector

The technological development in digitisation capabilities during last couple of decades has initiated a massive transformation in the technology across industries and society in general. The pace of this change is rapid. While the positive impact of digitisation is expected to benefit all of Europe, some sectors and regions stand to gain more from this than others. To maximize the benefit, it is critical to set the agenda around the rapid digitisation of businesses and government services, to push national SME's to become European in terms of market ambition and to improve innovative digital skills in general. From the core base of what is today possible in electronics, driven by at least the last 50-year exponential price/performance improvements, a set of technology domains currently specifies the transformative 2025 digitisation agenda.

6.1.- Sensors

Sensors, as e.g. radio tags, have continued to rapidly decrease in size as well as in price. Billions of these small electronic components, known as the are everywhere collecting data, as part of the Internet-of-Things. For example, the RFID technology allows washing machines to automatically adapt their washing programmes to the clothes introduced, robots will separate waste depending on the composition of the objects, and sensors will monitor sensitive infrastructures to assure their structural integrity. As a result, processes are easier monitored and tasks automated. However, questions of data use and data protection is a major issue.

6.2.- Internet-of-Things and Next Generation Internet

Massive digital connectivity of everything is currently being realised. The Internet-of-Things is becoming a reality, enabled by mobile internet, cloud technology and novel hardware technologies like photonics and quantum computing. ICT has enabled improved, geographically distributed manufacturing processes underpinned by knowledge management systems able to cope with the entire production cycle from design to sales and service supply. Social networks and open innovation tools play an important role in the sharing and the generation of knowledge, with the next generation of Internet allowing increased functionality and intelligent searching. The widespread use of social media has created new ways of exchanging and sharing information influencing the behaviours of consumers, values and cultural expressions.

6.3.- Data, Data Analytics and Artificial Intelligence

Today's level of digitisation means that we as humans must accept that our working lives is to a very large extent managed online. As a consequence, individuals have had to accept that more of their personal information is held by private and public organisations. Even the move towards personalised manufacturing is based on personal information held by private companies. This has resulted in greatly strengthened personal data protection legislation, as well as service packages whereby citizens agree to the use of their private data in return for contracted benefits. Additionally, ubiquitous computing generates collections of huge complex data sets everywhere. To process these types of data new algorithms are developed that permit capture, storage, search, sharing, transfer, analysis, and visualisation. This has allowed new information to be derived by anyone that can provide the necessary software intelligence to greatly improve products and services. Artificial intelligence, based on advanced machine learning algorithms, continuously improves e.g. the automation of processes forming the basis for new smarter products such as automated, driverless cars and intelligent, hand held mobility management systems.

6.4.- Virtual and Augmented Reality

Augmented reality is a live indirect view of a physical, real-world environment whose elements are *augmented* by computer-generated sensory input such as sound, video or graphics on top of the real world. Augmented reality can enhance the perception of reality, whereas in contrast, virtual reality replaces the real world with a simulated one. Augmented reality is a radically new way of enhancing

the design and product development process as well as a core element in the digitised manufacturing process as a new digital way of visualizing virtual products prior to actual production.

6.5.- Collaborative Robots

Due to massive improvements price/performance in embedded electronics and software, mechanics and advanced materials the development of robots has reached a level where automation of almost the entire manufacturing process, at least for some industries, is possible. Especially collaborative robots, cobot's, designed to interact directly with humans as an integrated part of the manufacturing process in a safe, flexible and easy way, offer massive efficiency improvements of the manufacturing business of every size, also for SME's.

6.6.- Accumulated Effect of Combining Technologies

The accumulated effect of combining the different technologies accelerates the impact of the digital transformation even further and can improve product and service quality, safety, sustainability and reduce cost. Many of the necessary improvements in ways of securing technology interoperability has been made, as within collection and transmission of data from many different sources. Examples include technologies to provide industry with its smart, advanced infrastructure where ICT is used in combination with energy, mobility, water, financial, and knowledge infrastructures. Another example is the use of technologies, such as additive manufacturing and on-line, real time manufacturing monitoring tools used to provide industry with new products and production chain efficiency.

6.7.- From Products to Services – Building Ecosystems

Consumers ask for personalised products, as technologies and production processes allow for mass personalisation. Product ownership is no longer the only dominant market driver; consumers increasingly require "bundled" products with embedded ICT services, services that adds to the product experience or performance. The ability to have a complete ecosystem, e.g. with data from different business sectors, as an integral part of the development and product will offer more competitive services. ICT based social and open innovation as a new way to design and develop products add to this. Many companies will become more specialised, focussing on one particular part of the value chain, working in collaboration with other companies to develop products.

6.8.- Advanced Materials and Material Processing

The development of new materials has mitigated the scarcity of natural resources, and has enabled the development of new markets and products. For manufacturing the on-going revolution of the combined progress of the ability to design completely new and advanced materials with dedicated characteristics, with novel materials processing methods and tools as additive or even hybrid manufacturing, represent a transformational industry change at the same level as digitisation. These materials, combined with new assembly, moulding and machining technologies as well as advanced robots, significantly contribute to the further development. Finally, consumers increasingly choose products on the basis of social and environmental issues, although price remains the key issue. Consumers are aware that natural resources and raw materials are scarce. Products that are produced through clean industrial processes appear to be the first choice of consumers.

6.9.- Demands for Engineering, Technology and ICT Skills

The demand for qualified people exceeds supply. High-tech manufacturing increasingly needs highly skilled staff in engineering, science, technology and ICT. The global improvement in education partially fills the skills gap, and there is a major migration of skilled staff to places offering the best employment opportunities. For talents with the right skills, the do-it-yourself (DIY) movement, the concept where the user is directly involved in the design of products and services, additionally offers new opportunities. Digitization and 3D printers allows for profitable micro-factories where customers produce and assemble their own products, increasing the competitive race for skilled talents even more.

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