Module 2
Circular Economy in the Furniture Industry

FURN360

circular business training for the furniture and woodworking sectors

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Erasmus+

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Module 2

Circular Economy in the Furniture Industry

Unit description

UNIT 2.1

CIRCULARITY STATUS IN THE FURNITURE SECTOR

Objective of the unit	The aim of the unit is to know the circularity current status in the European furniture sector.
Learning outcomes	Knowledge: Recognize the current situation of the European Furniture sector in relation to the Circular Economy. Skills: Analyse the different conditions of European Furniture sector companies in relation to the Circular Economy situation of the sector. Competences: Select and identify the key aspects and take them into account when designing the Circular Economy strategy for the company.
Pedagogical approach	PowerPoint Reading materials (not compulsory)
Hours	1 hour
Assessment methodology	Quiz (at the end of the module)
ECVET	0,04 credits (0,46 the complete module)

Content

1. INTRODUCTION

The European furniture industry produces more than a quarter of the world's furniture (28%), representing a market of about 84 billion euros per year, employing about 1 million of workers.

The most significant furniture value producers are Germany, Italy, Poland, France and UK. The first four represent a combined share of almost 60% of total EU production.

The EU countries are also the major consumers of furniture, estimated in 68 billion euros per year, which means that EU28 countries are net exporters. The most relevant consumers per value are Germany, UK, Italy, France and Spain.

The consumption of EU28 countries is approximately 10.5 million tons of furniture per annum. About this consumption, 82% is related to the domestic sector and about 18% is related to the business to business market.

The profile of the EU Furniture Industry could be summarised as follow:

- Furniture is one of the most fragmented manufacturing sectors in Europe
- Predominance of SMEs
- Traditionally labour-intensive
- Complex and fragmented supply chain, with many phases that are often outsourced
- Various raw materials are used to manufacture furniture products (from wood to wood based panels, metals, plastics, textile, leather and glass).

Figure 1: About Furniture Sector[1]

1.2. Type of enterprises and number of employees

It is estimated that there are around 130,000 of furniture enterprises in Europe, distributed as showed in Figure 2. The Figure 3 shows the distribution of the number of employees in these companies:

[1] *Source: EFIC - The European Furniture Industries Confederation.- https://www.efic.eu*

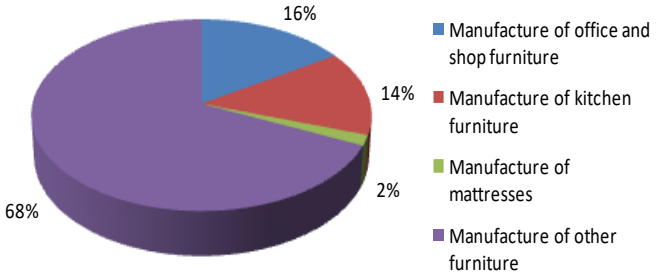

Figure 2: Distribution of furniture manufacturing enterprises[2]

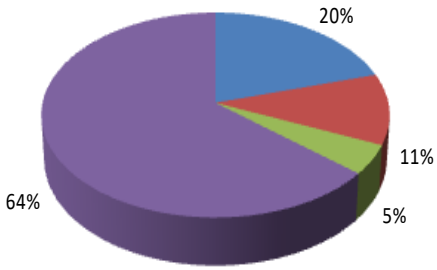

Figure 3: Distribution of the number of employees in furniture manufacturing enterprises

The average number of employees per company is around 8 employees, being higher in companies manufacturer of mattresses (about 19 employees). The following shows the distribution by number of employees per enterprise[3]:

Table 1: Distribution by number of employees per enterprise in the EU furniture sector

	Between 0 and 9 employees	Between 10 and 19 employees	Between 20 and 49 employees	Between 50 and 249 employees	More than 249 employees
No. of companies	85%	8%	4%	2%	0.4%
No. of people employed	24%	12%	15%	26%	22%

The furniture industry is essentially an assembly industry. As such, labour costs constitute a relatively important component of the final retail cost of furniture. Indeed, in the European furniture manufacturing sector, the incidence of personnel costs on the whole production costs is on average around 25%.

1.3. Type of products and materials used

The distribution of type of products by sub-segment is shown in Figure 4[4].

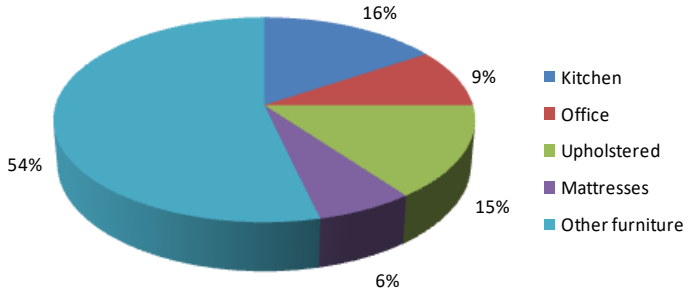

Figure 4: EU28 Furniture production by sub-segment

[2] *Source: Eurostat*
[3] *Source: CSIL based on Eurostat*
[4] *Source: CSIL processing of data from official sources*

Regarding the **materials used** in the furniture sector, the following table shows the breakdown of products by the main raw materials used in the production (EU28 furniture production)[5].

Table 2: Breakdown of products by the main raw materials used in the furniture sector

Type of material	Production value
Wood furniture	57%
Metal furniture	12%
Soft furniture (upholstered, mattresses) (textiles, rubber, leather, etc.)	20%
Furniture in other materials (plastic, bamboo, rattan, cane, glass, etc.)	11%
Total	100%

The Figure 5 shows the share of materials used in EU28 furniture (by value)[6].

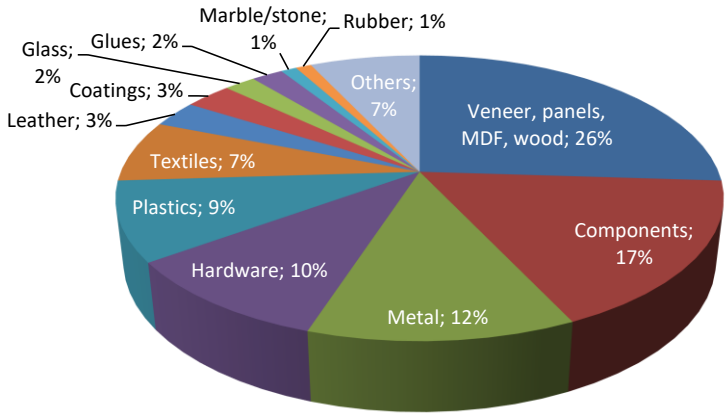

Figure 5: EU28 Share of materials used in furniture production (by value)

2. CIRCULARITY IN THE FURNITURE SECTOR

According to different sources of information, furniture waste in the EU accounts for between 2 % and 5 % of the total municipal waste (MSW). If it is assumed a 3.75%, this would represent about 10.78 million tons per year (more or less the substitution quantity indicated by the consumption of EU members). The furniture waste by EU Member State is showed in Figure 6[7].

[5] *Source: CSIL processing of Eurostat/PRODCOM data*
[6] *Source: European Commission*
[7] *Source: EEB – European Environmental Bureau from Eurostat*

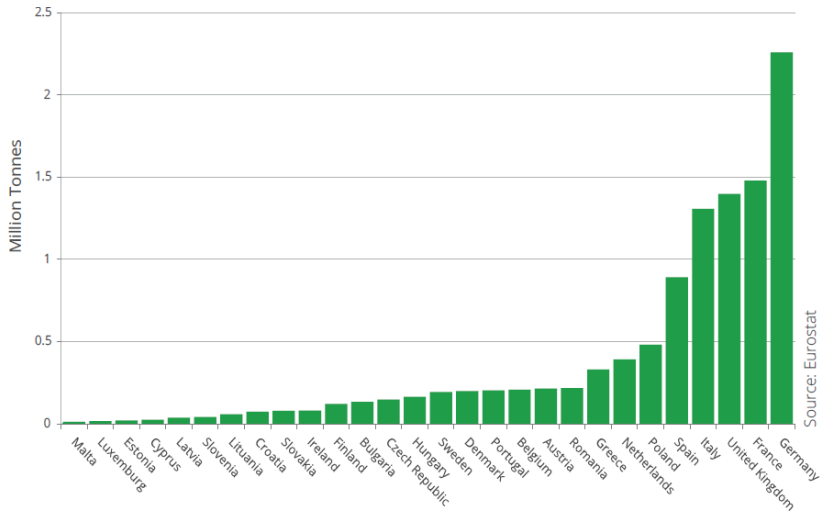

Figure 6: Furniture Waste by EU Member State

The destinations of this discarded furniture are mainly landfill and incineration (between the 80% and 90% of the total), with only about 10% recycled. This indicates the **low level of circularity in the sector**, as reuse and remanufacturing activities are also low.

The main **reuse activities** are associated with:

- Commercial second hand shops
- Social enterprises or charities
- Exchange via exchange platforms, such as eBay

It is difficult to know the quantity of reused furniture at European level, but some data from UK (Furniture Reuse Network) indicates that around the 6% of the total furniture classified as waste is reused in this country.

Regarding furniture **remanufacturing**, it is estimated that its turnover and employment account for less than 0.1 % of the total furniture industry.

There is **not a common end-of-life scenario for furniture in Europe**. Each country has its own type of waste infrastructure, which have different levels of implementation. In some Member States, waste recovery, recycling and waste treatment technology is underdeveloped.

The most advanced example can be found in **France**, where a specific Extended Producer Responsibility (EPR) programme is put in place for domestic and commercial furniture managed and operated by Eco-Mobiler (https://www.eco-mobilier.fr) and Valdelia (http://www.valdelia.org/) respectively.

The system is supported via **levies** paid by furniture producers, retailers and importers. These levies can be reduced for new furniture placed in the market if the manufacturers meet environmental product criteria (Eco-Modulation Criteria). The Eco-modulation of the eco-fee pricing scale is an incentive for furniture traders, designed to promote products which are easier to recycle and thus helping to minimise waste.

There are two main issues associated to the circularity of wood products, which are “Cascading use of wood” and “Bio-economy”.

2.1. Cascading use of wood

The cascading use of biomass resources allows an efficient use of these resources. For example, these can be wood and agricultural products and their more efficient use refers to a reduction of natural resource and material, but also a reduction of land use for their production. This change in the use of these valuable raw materials allows enhancing their productivity and their efficient use.

The principle of cascading use prioritizes those options that give a higher value use to the raw materials, such as their reutilization and as second option their recycling. Their destination for energy production is chosen only when other preferable options are not available. In other words, it prioritizes the biomass material use than its burning as it implies the destruction and loss of the raw material. Another preferred use to their burning for producing energy is also their use with "co-products" for making compost or nutrients that re-enter the natural cycle.

From the point of view of the cascading use, wood burning and incineration can be described as raw material leakage. Also for this reason, the importance and usefulness of the cascading use principle has already been recognized by several EU institutions.

It is important to emphasize that the cascading use principle should not be limited only to the recycling of raw materials. In line with the idea of the circular economy, maintenance and reuse of products needs to be encouraged also in the case of biobased products.

It is important to emphasise that the cascading use principle is only about the use of biomass resources. It does not cover the environmental and biodiversity impacts of their production or the full greenhouse gas balance of the biomass use.

The Circular Economy package does not contain mandatory targets for recycling or separated collection of other wood fractions like post-consumer wood from households, construction and demolition wood and furniture. Instead, wood waste is governed by more generic measures like **limits to the landfill of organic waste**, which do not specifically address recovery of waste wood. Recovery targets for other wood fractions could help to gain specific attention to the recovery and treatment of waste wood.

Solid wood as a furniture component usually maintains much of its natural state and therefore **quality**-wise has a great potential as a feedstock for wood cascades. Re-processed recovered wood in solid form has considerably better chances and value for recycling than the same wood quantity in small pieces. **Solid wood use in furniture,** as a result of ecodesign improvements and combined with adequate collection and recovery operations, could facilitate more cascading use by increasing the availability of secondary wood material of suitable quality.

Equally important to enhance cascading use of furniture materials is the development of loop solutions for wood-based boards, that are the most frequently used wood component in furniture production. Few other categories of (wood) products exhibit similar intensity of reuse as in the furniture sector. The following figure shows the wood cascade according to the circularity principle (source: https://thecircularreconomy.fandom.com/wiki/Cascading_Materials)

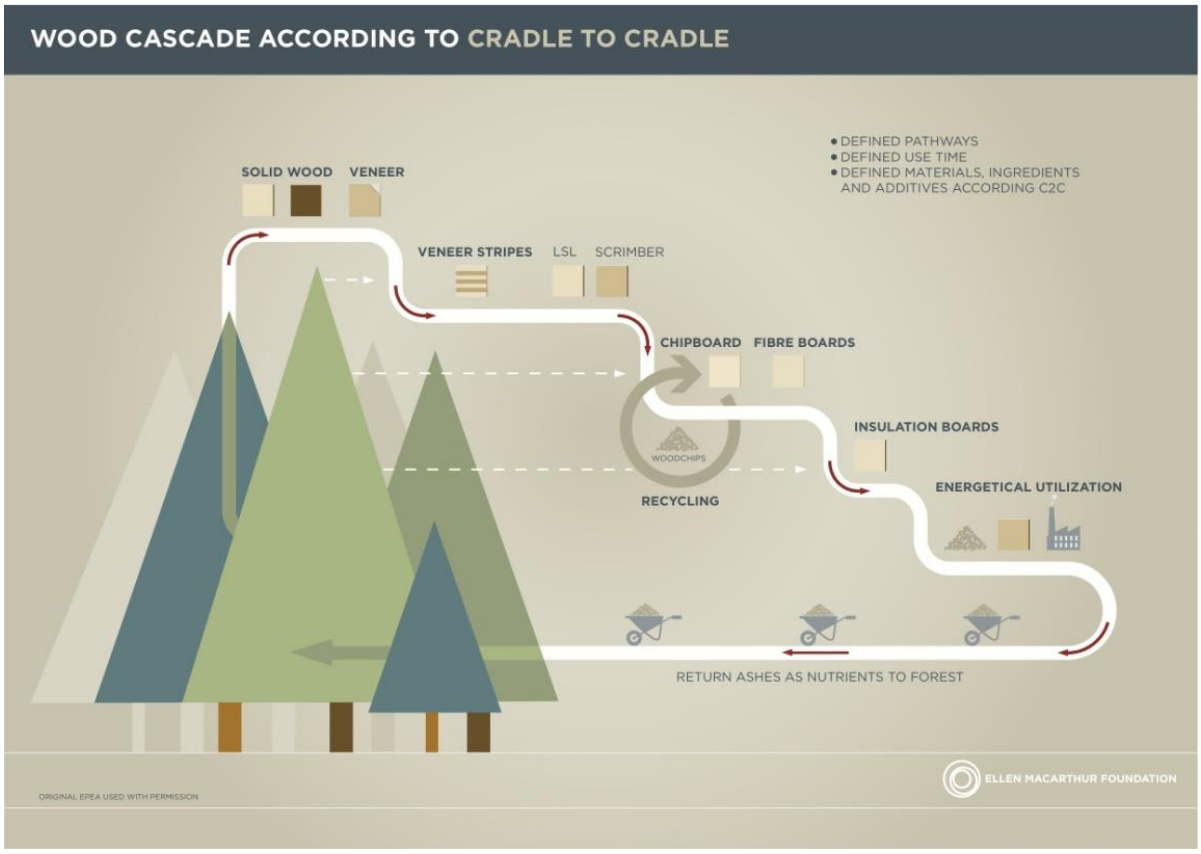

Figure 7: Wood cascade according to cradle to cradle (Ellen MacArthur Foundation)

Additional information can be found in the following publication of the European Commission: "Guidance on cascading use of biomass with selected good practice examples on woody biomass".- © European Union, 2018.

https://publications.europa.eu/en/publication-detail/-/publication/9b823034-ebad-11e8-b690-01aa75ed71a1/language-en/format-PDF/source-80148793

2.2. Bio-economy Strategy

In the EU, the bioeconomy concept was introduced in the middle of the last decade. *The bioeconomy covers all sectors and systems that rely on biological resources (animals, plants, micro-organisms and derived biomass, including organic waste), their functions and principles. It includes and interlinks: land and marine ecosystems and the services they provide; all primary production sectors that use and produce biological resources (agriculture, forestry, fisheries and aquaculture); and all economic and industrial sectors that use biological resources and processes to produce food, feed, bio-based products, energy and services (except biomedicines and health biotechnology)*[8].

The following figure shows the bioeconomy concept (source: European Commission).

[8] A sustainable Bioeconomy for Europe: Strengthening the connection between economy, society and the environment https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018DC0673&from=EN

The EU published its bioeconomy strategy in 2012 and updated it in 2018, which aims to speed-up the implementation of a sustainable European bioeconomy in order to make the most of its contribution to the 2030 Agenda and its Sustainable Development Goals (SDGs), and to the Paris Agreement. The improvements to the strategy aimed also to respond to new European policy priorities, with a special attention to the updated Industrial Policy Strategy, the **Circular Economy Action Plan** and the Communication on Accelerating Clean Energy Innovation. All of them admit the relevance of a sustainable, circular bioeconomy to achieve their own objectives.

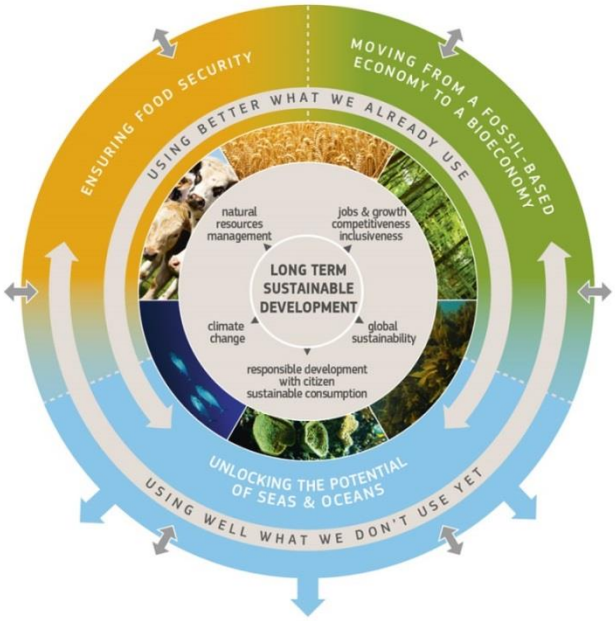

Figure 8: Bioeconomy concept

This update designed an action plan including 14 concrete actions to be launched in 2019, and based on three key priorities:

- Strengthen and scale up the bio-based sectors, unlock investments and markets
- Deploy local bioeconomies rapidly across the whole of Europe
- Understand the ecological boundaries of the bioeconomy

The EU has not produced specific EU policies and legislation in other sectors that use biomass, such as the wood and **wooden furniture,** textile, and pulp and paper sectors. Anyway, they are affected by different common initiatives and policies such as the raw material initiative, which stresses the shortage of biomass and the importance of the circular economy package.

For more information visit: https://ec.europa.eu/research/bioeconomy/index.cfm

3. MAIN TAKEAWAYS

The furniture sector is important in Europe, representing about ¼ of the furniture market in the world. The EU28 member states generate about 10.7 million tons of furniture waste per year, which mainly finished in landfill or used for energy production.

The reuse/remanufacture alternatives are minority, and mainly based on Commercial second hand shops, Social enterprise companies or charities and via exchange platforms, such as eBay.

Reuse of furniture is labour intensive as it involves collection, sorting, testing, refurbishment and reselling. The furniture waste is bulky and heavy, and difficult to transport, increasing the logistics costs.

Circularity for wood-based products as furniture is reinforced by the cascading use of furniture material by the development of loop solutions for wood-based boards and the implementation of the bioeconomy strategy.

UNIT 2.2

SECTOR SWOT ANALYSIS: CHALLENGES, OPPORTUNITIES AND BARRIERS

Objective of the unit	The aim of this unit is to understand internal and external aspects to take into consideration in the transition/roadmap toward a more circular economy.
Learning outcomes	Knowledge: Identify and recognize the main challenges, opportunities and barriers for the implementation of the Circular Economy in the furniture sector. Skills: Analyse the company current position in relation to the situation of the Circular Economy in the Furniture Sector. Competences: Select and identify the main challenges, opportunities and barriers for the target company and take them into consideration in designing the proper Circular economy strategy.
Pedagogical approach	PowerPoint Infographic Reading materials (not compulsory)
Hours	2 hours
Assessment methodology	Quiz (at the end of the module)
ECVET	0,08 credits (0,46 the complete module)

Content

1. INTERNAL AND EXTERNAL FACTORS

There are some internal and external characteristics and factors of the furniture sector that can influence the Circularity transformation in the sector.

Table 3: Internal and external factors that can influence circularity in the furniture sector

INTERNAL FACTORS	EXTERNAL FACTORS
• Fragmented manufacturing sector • Predominance of SMEs • Traditionally labour-intensive • Complex and fragmented supply chain, with many phases that are often outsourced • Use of various raw materials (from wood to wood based panels, metals, plastics, textile, leather and glass) • Use of hazardous substances (including flame retardants)	• Manufacturing growth in emerging markets. The Chinese furniture industry has now become a huge integrated industry with more than 5 million employees, exporting nearly 30% of its production and satisfying 99% of the domestic demand. It represents more than the 40% of the total world furniture production • Improved logistics to import products (reducing export costs from India, China, etc.) • Declined tariffs on foreign trade • Increased demand for low-cost products • Increased raw materials, labour and energy costs in Europe • Consumer demand for sustainable products • Lack of common approach for furniture waste management in Europe

2. SWOT ANALYSIS OF THE SECTOR

The heterogeneity of the EU furniture sector in terms of production systems, market conditions, product peculiarities and end-of-life scenario influence the circularity potential of the sector. The SWOT analysis presented hereafter takes these differences into considerations, but analyses some common features[9].

2.1. STRENGTHS

All range activities of the furniture production value chain are present in the EU.

EU furniture manufacturers can count on a variety of inputs, from materials, to components and finishing, and on a wide network of companies and qualified staff highly specialized in different parts of the productive process. This enables manufacturers to adapt production, to differentiate and customize products both in terms of materials, finishing and design.

High quality raw materials and components suppliers

In particular, EU wood based panels manufacturers are large, spread across the whole EU and they are competitive and innovative. Due to the central role that the furniture sector plays in

[9] *Source: "The EU furniture market situation and possible furniture products initiative". Final Report. Centre for European Policy Studies for the European Commission.*

terms of their reference markets, EU wood-based panel manufacturers pay particular attention in meeting the sector's demands. Other examples are special leather and textiles for upholstery and high performance hardware for furniture.

Advanced production technology and unique know-how

Companies operating in the woodworking machinery industry are leader at global level and they offer solutions which enable extremely performing and adaptive production systems. This is essential both to increase productivity (a key issue in mass production), but also to increase companies' possibilities to produce a wider range of products or products finishing.

Values other than price

Furniture manufacturing has a long history in Europe. This, together with cultural heritage, gives European manufacturers a competitive advantage in embedding innovation into furniture products, researching different styles and facilitating the development of creative competences. At present, these competences are recognized at world level.

Leading design and research centres

EU furniture manufacturers are trendsetters at global level. Although companies implement outsourcing or production fragmentation strategies, Europe still retains core competences in design, research and product innovation that can help companies to take advantages along their value chain, increasing their share of value added. EU manufacturers also hold a prestigious image among designers, media and consumers.

Considerable market size

The EU furniture market is mature and dynamic. Even with the emergence of new fast growing markets on the global scene and despite the recent crisis, the sector accounts for around one quarter of global furniture consumption. This is a strength for European furniture manufacturing companies that can take advantage of the proximity with final consumers, provided that they adequately satisfy demand both in terms of offered product and services.

Ready to embrace sustainability and environmental performance

Several EU furniture manufacturers have made clear their commitment to sustainability by joining voluntary schemes at national and EU levels. In addition, they have some advantages in comparison to some of their competitors in other world regions thanks to existing EU and national rules. This is an asset when it comes to meeting the demand of environmentally-conscious consumers. It also gives EU manufacturers a comparative advantage in understanding and managing the environmental impact of their products through the calculation of carbon footprints, life cycle analysis, compliance with requirements on recyclability, social responsibility, circularity and so on.

Cluster cooperation and interaction

There are some conditions that represent a key strength of the EU furniture industries for the positive impact they have on companies innovation and R&D, such as: the presence of furniture clusters in several EU countries and regions, clusters cooperation and repeated interactions between different actors along the whole value chain.

2.2. WEAKNESSES

High labour cost

The sector is labour intensive and the incidence of labour costs in furniture production is relatively high in the EU. This makes European furniture producers weaker in comparison to competitors' countries with low labour costs. Yet, it is not only the labour cost that is hampering the competitiveness of the EU furniture industry. Increased reliance on imported materials and components with associated trading challenges and currency fluctuations are also an issue, particularly when coupled with raw materials shortage and rising prices. The concentration of raw materials suppliers often places these in a dominant position.

Ageing workforce

The sector ageing workforce and the sector poor capacity to attract young workers are other concerning issues. This leads to a shortage of skilled workers that becomes particularly problematic when it is also coupled with outdated training infrastructure.

Weak demand determinants

Investments in residential construction are lower than some years ago and consumers' income availability has diminished. Many producers operating in the middle price range are losing their traditional markets and, under strong pressure from low cost competitors (within or outside the EU), are struggling to undertake a re-positioning strategy. Reduced levels of public spending further contribute to this trend.

Prevalence of SMEs, with limited access to finance

Without adequate support, this partly discourages investments in innovation or in a stable commercial presence (e.g. showrooms, warehouses), which may be particularly needed in distant emerging markets. In this respect, and as observed for all sectors SMEs, internationalization remains a challenge.

Protectionist measures in non-EU markets

While the EU is the most open global market, protectionist measures exist on other international markets, with tariffs on EU furniture exports thus creating market distortions.

2.3. OPPORTUNITIES

New markets

Russia, China and Persian Gulf countries are attractive markets, with an increasing number of potential buyers in the high-end segment, where competition (both local and international) is relatively low. In some of these countries expenditure in furniture and furnishing has a relatively higher priority than in the EU and the contract segment is also developing fast.

Relatively limited exports

Export flows mainly relate to the activities of large internationalized firms or companies operating in niches (contract, design, and so on) and/or under strong brands. Through adequate support aimed at increasing their visibility on foreign markets, other companies

(SMEs or companies operating in the middle market range) could participate in the regional/global value chains, also by exporting intermediate products.

Opportunities arising from the construction and renovation sector

Buildings construction and renovation are drivers of furniture purchases. In this context, sustainable construction and eco approaches in renovation stress the importance of the use of raw materials from sustainable sources and high performing materials. This trend could lead to an increasing number of environmentally conscious end-users also in the furniture sector. These trends may also affect firms' competitiveness and facilitate them upgrading their value chain. However, to fully tap this potential, consumers' awareness should be further increased.

Changing consumption patterns

As a general trend, once being lifetime purchases, at present, furniture buying is more fragmented and responds also to other needs than durability (e.g. functionality, adaptability to small spaces). Changing demographic trends (e.g. ageing of the population) also generate specific demands in terms of targeted products. European furniture manufacturers, thanks to their proximity to the market, can have a competitive advantage, provided that those trends are adequately interpreted and the offer responds to customers' new needs. In this respect, retailers, which have a closer interaction with consumers, may have a role to play, too.

Exploit comparative advantages: compete on quality and environmental profile

Further integration of productive systems within Western and Central Eastern Europe and along the entire value chain, could increase the sector competitiveness to deal with foreign competitors and facilitate a trend toward more efficient and leaner manufacturing.

Improve/update skills

Research in advanced manufacturing technologies can result in the creation of high technology and knowledge intensive jobs, which, together with a higher competitiveness, would increase the sector employment attractiveness and facilitate the sector workforce rejuvenation.

2.4. THREATS

Fierce competition from Asia

During the last years we could see a growth of furniture imports from Asia, particularly in the low and mid-range price segments, and the recent crisis further accelerated this process. In some European countries, even large markets, it has become an established phenomenon, and in others, where the prices advantage of Asian products is lower, penetration is still marginal in terms of value, but it is increasing.

Cost and availability of raw materials

Fluctuations in raw material prices and problems related to the availability of products respecting environmental, sustainability and technical standards and regulations are factors upstream in the value chain that could negatively impact furniture production.

Insufficient protection of IPRs (Intellectual Property Rights)

The furniture industry is increasingly reliant on products with high intangible contents (brand, design). Its competitive advantages will strongly depend on its level of protection in global markets. Today, the main form of IPR infringement is the sale of copies of well-known designers' pieces at a cheaper price, mostly on Internet.

Evolution of retail markets

Several large scale distributors are investing resources both in logistics and in creating overseas networks in order to be competitive on prices, particularly in the middle/low end of the market.

Increasing quality of non-EU products

If European manufacturers are not able to successfully upgrade along the value chain, the constant quality progress of products from foreign countries could lead competition out of a pure price matter. In addition, national design development in foreign markets could lead to increasing competition in the EU export destinations. The fact that EU exports high quality components and machinery may accelerate this trend in the medium term.

Uncertain demand for sustainability features in products

There could be a gap, in the short run, between the expectations of EU furniture manufacturing companies embracing the principles of sustainability (and its cost) and the real answer from the retailers/consumers' side. This could discourage initiatives in this direction.

Strict(er) product, environmental and health and safety regulations

Existing rules applicable in the EU are comparatively stricter (and more costly to comply with) than those existing in several areas of the world, especially in emerging markets. Whenever EU producers compete at the global level with manufacturers that are not subject to equally strict requirements, their international competitiveness is penalized.

3. BARRIERS TO CIRCULARITY

The following barriers to circularity have been identified in different studies:

Materials lower quality and poor design

The passage from furniture made of solid wood and metal to cheaper materials such as plastic, chipboard and medium-density fibreboard (MID) limit the potential of product reuse or remanufacture. Regarding the design, the products are not designed for an easy disassembly, reassembly or reconfiguration. They are mainly designed for easy assembly.

Weak specification drivers

There are weak or no drivers facilitating the improvement of aspects such as recycled content, reuse of components, product durability and design for disassembly/reassembly, repair, reuse,

remanufacture and recycling. Regarding product durability, the short product warranties do not incentive manufacturers to design for longevity, and the original equipment manufacturers (OEMs) and retailers see products life extension as a potential cause of reduction of new products sales.

REACH Regulation (on Registration, Evaluation, Authorisation and Restriction of Chemicals)

The obligations associated with hazardous substances introduce additional costs for recyclers, because producers often fail to inform about the hazardous substances contained in the products and how to safely remove them.

Consumers' poor information and poor availability of spare parts

The consumers are rarely informed about how to maintain and repair furniture products in order to prolong and extend the product lifetime. One example could be the importance of keeping the fire labels, and not cutting them off. The lack of this label could prevent the reuse of the product. It is also important the availability of spare parts or components to repair the furniture and thus extend its lifespan (this absence will encourage the purchase of a new product).

Limited collection and reverse logistics infrastructure

The collection and logistics for furniture take-backs require relevant investment to cover the cost of transportation, labour and wider infrastructures associated with collection and storage. On the other hand, there are few and weak incentives to do so, such as product responsibility mechanisms, which are quite rare in the furniture sector. The furniture waste is bulky and heavy, and difficult to transport. It creates difficulties to municipalities to collect these items separately (for example mattresses) and also a problem for treatment facilities.

High cost of repair and refurbishment

Transport and labour cost are high in most EU countries. This makes any significant repair and refurbishment services expensive, particularly where re-upholstery is required. This only makes sense with particularly high value items. Volunteer or social labour could improve the economic balance, but in general, economies of scale are needed to make repair and refurbishment feasible.

Weak demand for second hand furniture

The difference in prices between new and second-life furniture is not sufficient to push consumers to buy the second one. This purchasing behaviour is facilitated also by poor awareness of the availability and benefits of sustainable furniture options, consumers' desire of more fashionable new products and the perception of lower quality of second-hand products.

Poor demand for recycled materials

There is not sufficient demand for recycled materials, in some cases because market for recycled materials are underdeveloped, and in some other cases because the market is saturated due to limited demand. This situation restricts further investments in recovering processes.

Weak over-arching policy drivers

Underinvestment in reuse, repair and remanufacturing infrastructures limits these options and lead to prioritizing recycling, incineration or landfill, and thus to not properly managing furniture in accordance with the principles of the waste hierarchy.

UNIT 2.3

LEGISLATIVE TRANSITION INSTRUMENTS

Objective of the unit	The objective of the unit is to understand the legislative instruments to facilitate and succeed in the transition to a circular economy.
Learning outcomes	Knowledge: Recognize the basic characteristics of the Circular Economy main legislative instruments concerning the Furniture sector. Skills: Analyse the main outputs and consequences of these legislative instruments and recognize how they can be applied and employed. Competences: Deploy the most relevant legislative instruments within the Company in the framework of its Circular Economy strategy.
Pedagogical approach	PowerPoint Infographic Reading materials (not compulsory)
Hours	3 hours
Assessment methodology	Quiz (at the end of the module)
ECVET	0,12 credits (0,46 the complete module)

Content

1. LEGISLATIVE INSTRUMENTS TO CIRCULARITY

The following Legislative instruments can be a force to introduce circularity in the furniture sector. Most of them are not only affecting the furniture sector, but other sectors as well. The analysis of these instruments tries to highlight how these instruments can influence the future activities on increasing the circularity and reducing the environmental impact of furniture and habitat products.

1.1. Circular Economy Action Plan

In 2015, the European Commission adopted an ambitious **Circular Economy Action Plan**, which includes measures that will help facilitating the **transition** of the European industry towards a circular economy, to improve European competitiveness at global level, promote sustainable economic growth and very important, generate new jobs.

This EU Action Plan identifies **concrete and ambitious actions** and measures covering the whole industry cycle: from production and consumption to waste management, and to the support for secondary raw materials markets and to a revised legislative proposal on waste. The action plan annex provides a **timeline** with information of when the different actions will be implemented.

The actions identified will provide a key contribution **to "closing the loop" of product lifecycles** increasing products recycling and re-use, that will clearly benefit both the local environment and the European economy.

The updated legislative framework on waste came into force on July 2018. It clearly identifies **targets for reducing waste** and launches an ambitious and credible long-term pathway for waste management and recycling.

The key elements of this legislative framework include:

- A common EU target for recycling 65% of municipal waste by 2035;
- A common EU target for recycling 70% of packaging waste by 2030;
- There are also recycling targets for specific packaging materials:

Paper and cardboard: 85 %	Ferrous metals: 80 %
Aluminium: 60 %	Glass: 75 %
Plastic: 55 %	Wood: 30 %

- A compulsory target of a maximum of 10% landfill of municipal waste by 2035;
- It strengthens separate collection obligations and it extends it to hazardous household waste (by end 2022), bio-waste (by end 2023), and textiles (by end 2025).
- Identify minimum requirements for extended producer responsibility schemes and thus improving their governance and cost efficiency.
- Strong reinforcement of prevention objectives, in particular, requiring Member States to take specific measures to tackle food waste and marine litter as a contribution to achieve EU commitments to the UN SDGs.

As part of its continuous effort to transform Europe's economy into a more sustainable one and to implement the ambitious Circular Economy Action Plan, in January 2018 the European Commission adopted the latest set of measures, including:

- A Europe-wide **EU Strategy for Plastics** to transform the manner plastics and plastics products are designed, produced, used and recycled. By 2030, all plastics packaging should be recyclable.
- A Communication on options to address the **interface between chemical, product and waste legislation** that assesses how the rules on waste, products and chemicals relate to each other.
- A **Monitoring Framework on progress** towards a circular economy at EU and national level. It includes a set of ten key indicators which cover each phase – i.e. production, consumption, waste management and secondary raw materials – as well as economic aspects – investments and jobs - and innovation.
- A **Report on Critical Raw Materials** and circular economy that emphasizes the potential to make more circular in our economy the use of the 27 most critical materials .

Moreover, in 2018, the European Commission approved other ambitious initiatives in the framework of the Circular Economy Action Plan:

- A proposal for a Directive on the reduction of the impact on the environment of **certain plastic products** - implementation of the EU Strategy for Plastics in the Circular Economy.
- A proposal for a Regulation determining minimum requirements to boost the efficient, safe and cost-effective **reuse of water for irrigation** - deliverable of the Circular Economy Action Plan.

For more information visit the web page of the European Commission on this field: http://ec.europa.eu/environment/circular-economy/index_en.htm

1.2. Extended Producer Responsibility (EPR) schemes

According to the OECD definition, the Extended Producer Responsibility (EPR) is *"an environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle".*

This policy approach firstly appeared in the early '80s in a few European Member States, especially for packaging waste, and since then it has continuously spread across the EU (and outside).

EPR should make possible **that internalising environmental externalities**, should push producers bear in mind environmental aspects and externalities along the products lifetime, **starting at the design phase till their end-of-life**. In this framework, EPR should be considered a key tool supporting the implementation of the European Waste Hierarchy and Circular Economy.

At EU level, **three Directives introduce EPR** as a policy approach: the EoLV (end of Life Vehicles) Directive 2000/53/EC, the WEEE (Waste of Electrical and Electronic Equipment) Directive 2012/19/EU and the Batteries Directive 2006/66/EC. EPR is also widely used in support of the implementation of the Packaging and Packaging Waste Directive (94/62/EC), although the Directive itself does not make the principle compulsory.

However, we should remind that, beyond these types of waste, in some countries, Extended Producer Responsibility schemes **can cover other products**, notably: used oils, used tyres, graphic paper and textile, as well as many other kinds of products such as: medicines, fluorinated refrigerant fluids, agricultural films, mobile homes, furniture, etc.

Moreover, article 8 of the Waste Framework Directive 2008/98 identifies some **standards for EU Member states related to the EPR implementation**, providing a reference scheme for its implementation. EU Member States and their legislative bodies are accountable for the EPR implementation, including the design of its operational aspects.

However, the EPR is not widely used in the **furniture sector**, with France being the only Member State to have implemented it to drive the collection, recycling and reuse of furniture arising from the domestic and commercial waste stream, managed and operated by écoMobilier (https://www.eco-mobilier.fr) and Valdelia (http://www.valdelia.org/) respectively. The system is supported through charges paid by furniture producers, retailers and importers.

On the contrary, and while we lack a mandatory producer responsibility, self-regulation (or voluntary industry agreements) provide an different approach to funding infrastructures for increasing take-back, reuse and recycling practices. This could be the case of WRAP (in the UK), which pushes changes through voluntary agreements within the industry, and which seek to increase waste collection and management in accordance with the waste hierarchy.

1.3. REACH Regulation

REACH (EC 1907/2006) objective is to improve the both human health and environment protection by identifying better and at an earlier state the hazardous properties of chemical substances used in EU. REACH regulation is based on four processes: **registration, evaluation, authorisation and restriction of chemicals**. REACH has been thought also as a stimulus and instrument to increase EU chemicals industry innovation and competitiveness.

This regulation foresees that industry is directly responsible to manage those risks coming from chemicals products and obliges to make available information on the safety of the different substances used. Both manufacturers and importers have the responsibility to collect information on the specific and critical properties of chemical substances they use. Following the registration of the relevant information in the **European Chemicals Agency (ECHA)** central database in Helsinki, this system facilitates to handle chemical substances in a safer way. The ECHA is essential for the REACH system: it takes care of the databases needed for operating the system, it co-ordinates the detailed analysis of critical and suspicious chemicals and it is creating a public database accessible to professionals and consumers where these can find information about hazard substances.

Another relevant request of this Regulation is to **progressively substitute those chemical** substances identified as the most dangerous (called "**substances of very high concern**") whenever appropriate substitutes have been recognised.

The REACH Regulation was prepared and adopted as many chemical substances were produced and sold for several years in Europe, sometimes in large quantities by the industry and yet**, not enough information are available** on the risks and hazards they represent for workers' and consumers' health and to the environment. There is a clear need to fill the gaps of the related information and to secure that EU industries are capable to evaluate substances risks and hazards, and to facilitate the detection and implementation of a proper risks management to protect humans and the European environment.

REACH entered into force in 2007, and its phases implementation is foreseen on a period of 11 years. Additional detailed information and explanation can be found on the following website: REACH on the DG GROWTH (Internal Market, Industry, Entrepreneurship and SMEs - http://ec.europa.eu/growth/sectors/chemicals/reach) or ECHA - https://echa.europa.eu/.

In relation to this, the main problem in the Furniture sector is that most of **furniture items** have a quite **long duration**. This could represent an advantage when thinking about the limit use of chemical in the manufacturing processes, but it is a critical aspect when the products have to be remanufactured or recycled, for example in ten years' time. It is relevant to stress that REACH does not prevent products direct reuse as it does not apply to second hand products, but organizations promoting products reuses may see positively **limiting the resale of items with hazardous substances** for humans or the environment.

It can also cause an increase of **costs in products preparation for reuse organisations** and recyclers, particularly as a result of the lack of information (e.g. via a detailed product Bill of Materials) related to the presence or not of hazardous substances contained in the products and how these can be dealt without unduly or unnecessarily reducing items circularity.

1.4. Ecodesign Directive

The Directive "Ecodesign of Energy-related Products Directive" (ErP) 2009/125/EC creates a **framework** for defining Ecodesign requirements (such as energy efficiency) for all those products that use energy or which are energy-related products (ErP) in the residential, tertiary and industrial sectors. This Ecodesign Directive is accompanied by Regulation (EU) 2017/1369 defining the rules for energy labelling. The overall objective of these directive and Regulation is to reduce the products environmental impact in different cost-effective manners, which includes the energy consumption along the product whole life cycle.

Energy related products are defined as those products using or converting energy carriers in the form of gas, oil, electricity or others (such as a boiler, an energy using product) or that provoke the use of additional energy (e.g. a window, causing heat losses, is causing as well an increase of energy use by the boiler, - therefore the window is titled as energy-related).

Considering the **furniture sector**, the Ecodesign Directive would apply to furniture that uses energy for their operation, but nowadays, there is not a specific regulation covering this type of products. However, the Circular Economy Action Plan also includes a commitment to examine new options under the ecodesign directive.

The **Ecodesign Directive Process** for Product Groups is the following:

- The product group is part of the EU Commission's Ecodesign **Work Programme**.
- The European Commission launches a **preparatory study** involving experts and stakeholders (industry, NGOs), generally lasting 1-2 years.
- Based on study outcomes, the Commission publishes a **Working Document** with policy options suggestions.
- One month later, EC organizes a discussion about this working document in the "**Consultation Forum**" involving stakeholders including NGOs and industry groups.
- Following an **economic and social impact evaluation** the EU Commission proposes an EU regulation, usually 3 months after the Consultation Forum. Member States officials, composing the Regulatory Committee, vote about this **draft proposal**. Amendments can be discussed and a qualified majority has to be reached for the approval of the final regulation.
- **Adoption** of EU Commission in cooperation with EU countries.
- "**Scrutiny**" by EU Parliament (and with Lisbon also by EU countries), where a majority of EU parliamentarians (or EU countries) can stop a measure, usually taking 2 months.
- Official **entry into force** of regulation(s).
- Typically, 1 year after that regulation enters into force, companies must put on the EU market only products that respect the regulation and that have the required labels. **Only such products can have the "CE" label.**
- Typically 2-3 years later stronger energy efficiency requirements are introduced as a second step.
- Typically 4-5 years after a regulation enters into force it is **reviewed**, and an update of its content might take place.

The implemented regulations cover nowadays the following product groups:

Table 4: Product groups covered by implemented regulations in the Ecodesign Directive

Air conditioners and comfort fans	Air heating and cooling products	Circulators
Computers	Domestic cooking appliances	Electric motors
External power supplies	Household dishwashers	Household tumble driers
Household washing machines	Industrial fans	Lighting products in the domestic and tertiary sectors
Local space heaters	Heaters and water heaters	Power transformers
Professional refrigerated storage cabinets	Refrigerators and freezers	Simple set-top boxes
Solid fuel boilers	Standby and off mode electric power consumption of household and office equipment and network standby	Televisions
Vacuum cleaners	Ventilation units	Water pumps

On the 30th of November 2016, the European Commission adopted the third **Ecodesign Working Plan** for the period 2016-2019. The Working Plan included new product groups, such

as: building automation and control systems, electric kettles, hand dryers, lifts, solar panels and inverters, refrigerated containers, and high-pressure cleaners.

There are a few other novelties in this new Working Plan (2016-2019) especially concerning **Circular Economy**. The **resource efficiency** gets more attention from the Commission who will study the possible application of additional "product-specific" requirements on matters such as **durability** (e.g. minimum lifetime of products or critical components), **reparability** (e.g. availability of spare parts and repair manuals, design for repair), ease of **reuse and recycling** (e.g. avoiding incompatible plastics) among others.

Under **the Mandate M/543** from the Commission, CEN/CENELEC is developing standards to cover these issues for energy-using products, in order to potentiate the circular economy.

For more information visit: http://ec.europa.eu/growth/industry/sustainability/ecodesign_en

1.5. Waste Electrical and Electronic Equipment Directive (WEEE) and Restriction of Hazardous Substances Directive (RoHS)

In the EU, the amount of waste of electrical and electronic equipment (WEEE) is increasing much faster than others, among others, we refer to cell phones, TV-set, computers and fridges. In 2005 they represented in total around 9 millions of tonnes, and it is expected that by 2020 they become 12 million tonnes.

If not treated adequately, WEEE can create both human health and environmental problems, as materials and components that compose them are a complex combination containing hazardous substances. Moreover, manufacturing modern electronics needs scarce and expensive resources (e.g. around 10% of total gold worldwide is used for their production). In this framework, to improve the WEEE environmental management and to support the system adopting circular economy principles and thus enhance resources efficiency, we need to improve the electronics collection, treatment and recycling at the end of their life cycle.

Two different legislations were adopted to tackle these problems: The Directive on waste electrical and electronic equipment (**WEEE Directive**) and the Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment (**RoHS Directive**).

The **WEEE Directive** (Directive 2002/96/EC) entered into force in February 2003. The Directive enquires the establishment of collection schemes for consumers to return WEEEs without any charge. The objective is **to increase the WEEEs re-use and/or recycling**.

At the end of 2008, the European Commission launched a proposal to review the Directive to better deal the fast growing waste volumes. The new WEEE Directive 2012/19/EU entered into force on the 13th of August 2012 and became effective on 14th of February 2014.

EU legislation restricting the use of hazardous substances in electrical and electronic equipment (**RoHS Directive** 2002/95/EC) entered into force in February 2003. This legislation requires using safer alternatives for some materials and substances, such as flame retardants polybrominated diphenyl ethers (PBDE) and polybrominated biphenyls (PBB), heavy metals such as lead, mercury, cadmium, and hexavalent chromium. The revised RoHS Directive 2011/65/EU became effective on 3 January 2013.

Article 2 of the WEEE Directive determines that from 15th of August 2018, all EEE shall be classified within the categories set out in the Directive Annex III (**open scope**). Recently guidelines and position papers from various entities were published delivering their clarifications on the "open scope" approach. Currently, member states internally assess how to determine which products should undergo or not this legislation. As a result, a diverse group of potential new EEE is under discussion in member states, and **products such as furniture and clothes with electronic components may now become EEE**, this will depend on member states interpretation and their level of strictness- This could significantly increase the weight of EEE placed on the market and have wider implications for WEEE management.

These discussions have largely been prompted by the change in wording regarding when an item requires electric currents or electromagnetic fields in order to fulfil its basic function to enabling it to **work properly**.

For more information visit: http://ec.europa.eu/environment/waste/weee/index_en.htm

1.6. End-of-waste criteria

The end-of-waste criteria define when certain **waste stop being considered simple waste** and start to be define as product (or a secondary raw material).

According to Article 6 (1) and (2) of the Waste Framework Directive 2008/98/EC, specific waste shall stop to be considered normal if it has undergone through a **recovery process** (including recycling) and if it complies with specific criteria to be developed in line with certain legal conditions, in particular:

- the substance or object is commonly used for specific purposes;
- there is an existing market or demand for it;
- the use is legally allowed (it fulfils the technical requirements for the specific purposes and meets the existing legislation and standards applicable to products);
- its use will not cause any negative environmental or human health impacts.

Such criteria should be set for specific materials by the Commission using the procedure described in Article 39(2) of the Waste Framework Directive (so called "comitology"). A **mandate to set end-of-waste criteria** was approved in order to increase the level of environmental protection and produced environmental and economic benefit. Setting these criteria should foster recycling across EU through creating a clear legal framework and a level playing field and to eliminate needless administrative burdens.

Joint Research Centre delivered a **methodology** to develop the criteria (JRC reports). Following an agreement with the Member States about this methodology, the Commission is now preparing a set of end-of-waste criteria for priority waste streams. Until the date, the criteria have been identified for **iron, steel and aluminium scrap, glass cullet and copper.**

Regarding the **furniture sector**, wood waste stream (partially from furniture) has been analysed in the preparatory studies, considering the wood waste stream as *stream that may be in line with the principles*, but it is not clear for all cases that their current management in the EU takes place via recycling, or that recycling is a priority compared to controlled energy

recovery or landfill in suitable facilities (more detailed information is needed to define it as a priority).

For more information visit:

JRC Report: http://susproc.jrc.ec.europa.eu/activities/waste/index.html
DG Environment: http://ec.europa.eu/environment/waste/framework/end_of_waste.htm

1.7. Flame retardants

Today, in Europe, we have a variety of **flammability standards for furniture**. Some of these standards, which require compliance with open-flame tests, cause the use of potentially hazardous flame-retardant chemicals without that they have proven fire safety benefits. In such cases, the use of flame retardants is not legally requested, but it is in practice the needed way for compliance with **open-flame tests**.

We can see that some flame retardants can seriously harm both human health and the environment, put at risk furniture products quality and create an **expensive burden** for furniture producers. The use of flame retardant chemicals may strongly affect the furniture sector as they can prevent it from fully entering and implement the circular economy transformation. Flame retardants prevent many products to be safely recycled for material reuse, and make impossible to improve the waste handling and make it greener. Flame retardants in furniture **limit the products lifespan** as they reduce their duration. Moreover, flame retardants contained in furniture products make their **end-of-life treatment much more expensive** than normal waste and it can be more dangerous for the release of toxic fumes during their treatment.

When it comes to the **environmental impact**, flame retardants migrate out of products and spill in the environment. Many flame retardants are persistent and can undergo long-range environmental transport. Several scientific studies have demonstrated the presence of flame retardants in seas, rivers, and far away till the Arctic. They have been found in animals, such as bees and fishes, leading to the risk of persisting contamination in the food chain. Moreover, in terms of fire safety, several concerns have been raised with regard to the exposure to toxic fumes released from the combustion of materials containing flame retardants, which would significantly increase danger and risk in case of fire.

Different stakeholders joined in **The Alliance for Flame Retardant Free Furniture in Europe**. It involves environmental and health NGOs, the industry, cancer organizations, fire fighters and labour unions. This Alliance strongly aims to stop the use of flame retardants in furniture products. It supports **safer alternative ways of minimising fire risks**, because long-term exposure to hazardous chemicals represents a great threat to human health.

For more information visit: http://www.safefurniture.eu

1.8. Renewable Energy Directive

The Renewable Energy Directive designs an overarching EU policy for energy promotion and production from renewable sources. It demands that at least **20% of EU energy needs are**

satisfied by renewable sources by 2020– and this should be done through complying with specific national targets. Moreover, by 2020 all EU countries are required to secure that at least 10% of their transport fuels come from renewable sources.

The Commission proposed an updated Renewable Energy Directive to transform the EU into a global leader in renewable energy and secure that in EU at least **27% of final energy** consumption comes from renewable sources **by 2030**.

The Directive identifies, for each country, **national renewable energy objectives**, considering the starting level and the potentialities of each country for renewable energy production. The different EU countries can decide how to achieve these targets, as well their own national energy policy through their own renewable energy action plans.

In addition this Renewable Energy Directive defines some **sustainability criteria for all biofuels** produced or consumed in the EU. The aim is to secure that their production processes respect sustainable and environmental friendly criteria. Enterprises can attest they respect the required sustainability criteria through national systems or through voluntary schemes recognised by the European Commission.

The biofuels industry is put under pressure, because of the booming demand for alternative fuels. It sees potential raw materials for second-generation biofuels in different **waste streams**, agricultural residues and forestry-based biomass. **Wood-based panels and furniture** represent model examples of the Circular Economy. At the end of their material life, these can still become an input for renewable energy production.

Although wood has many uses (pulp, furniture, structural material, etc.), most of the high-value uses require wood types that are not intended for energy (for which the cheapest cellulosic sources is sufficient). In spite of recognizing that a certain level of competition among different end-uses of wood will be always present, the feedstock competition for the conversion of wood into biofuels is likely to be smaller than the one related with agricultural crops.

For more information visit: https://ec.europa.eu/energy/en/topics/renewable-energy/renewable-energy-directive

1.9. EU Industry policy for Forestry and the forest based industries

The EU Commission adopted the **EU Forest Strategy** on the 20th of September 2013, which aims to help forests and the related sector to tackle current challenges. The Strategy provides a **framework** to respond to the increasing demands put on forests and to deal with societal and political changes that have affected forests during the last 15 years.

In 2018 the Commission delivered the report “Progress in the implementation of EU forest strategy” (COM(2018) 811 final) reviewing this strategy. The midterm review highlights that the EU forest strategy is achieving its objective to foster a more sustainable forest management at EU and global level. Adopting a new approach, the Strategy "goes out of the forest", dealing with aspects of its **value chain,** i.e. the methods through which forest resources are utilized to produce goods and services, which strongly affect forest management.

The Strategy stress that forests play a key role not only for rural areas development, but also for the overall **environment**: **fighting climate change**, increasing biodiversity, influencing **forest-based industries** and **bioenergy** production**.**

This strategy highlights we need a **holistic approach**, it requires to take into consideration that other policies have impacts on forests, and that we should take into account also other developments happening beyond forest boundaries. Moreover, it makes clear that, when designing their national forest policies, EU countries, should take into consideration all **forest-linked EU policies**.

It finally requires creating a European **Forest Information System** for collecting and having at disposal Europe-wide harmonised information.

For more information visit: https://ec.europa.eu/agriculture/forest/strategy_en

1.10. The Blueprint for the EU forest-based industries

The 2013 **Blueprint** for the EU forest-based industries (SWD(2013) 343 final), accompanying the new **EU Forest Strategy** (COM(2013) 659 final) and the associated **Staff Working Document** (SWD(2013) 342 final) underlines that the industry to remain competitive has to address a number of challenges:

- **Stimulating growth** for forest-based products in EU and non-EU markets.
- **Resource and energy efficiency** – in addition to innovation and securing their productivity, the EU Forest-based Industries should focus on using resources and energy in the most efficient manners to compensate their globally high production costs.
- **Raw materials** - a quarter of EU forests face legal and owners' limitations making more fresh wood purchasing increasingly difficult and costly. At the same time, EU is facing an increasing export of sawlogs toward global competitors and the payment of increasing other countries custom duties when importing wood.
- **Better logistics** are needed for raw material supply and product delivery.
- **Structural adaptation** the industry, composed of many micro companies, small and medium-sized enterprises (SMEs), to perform better and more efficiently need to create stronger cooperation across their value chains.
- **Innovation and RTD** - new products are needed to meet changing societal demands. Only new processes and business models can help this, such as bio-refineries.
- **Education and skills, the ageing workforce** - without re-training the workforce, technological improvements cannot be achieved. A shortage of young entrants into the industry means that existing skills are not being passed on from an ageing workforce.
- **Coherence of EU legislation** – to facilitate a foreseeable environment for companies, it is important to ensure EU legislation coherence and consistency.
- **Implementing EU Climate Policy after 2030** – considering the increasing greenhouse gas savings targets and renewable energy targets, demand for wood biomass will probably increase and wood-based products will need to be able to demonstrate their carbon storage potential.
- **International competition, trade, and cooperation** - in a global economy, low-cost producers competitors of wood-based products will increasingly penetrate EU

markets. Increasingly sophisticated, higher-value wood-based products can represent a competitive advantage in EU and non-EU markets. Cooperation can support this.
- **Information, communications, and image** - better information and communication of Forest-based Industries are crucial both within and with other sector. Based on this, a better image of the sector could be projected.

The Forest Strategy and the Blueprint identify various **activities to deal with the challenges** identified by the Commission, EU countries, and the industries themselves for the time period 2014-2020. Ongoing activities include:

- examining the opportunity of improving information on furniture products.
- conducting a cumulative cost assessment of EU legislation and policies affecting the sector.
- improving the understanding of the cascading use of wood, identification of barriers to its functioning, and good practices and measures to overcome them.
- facilitating the increased sustainable wood mobilisation.

For more information visit: http://ec.europa.eu/growth/sectors/raw-materials/industries/forest-based/strategy_en

Nowadays, **Bioenergy Europe**, CEI-BOIS, CEPF, CEPI, FTP, EFI, EPF and EUSTAFOR are working to propose the development of a strategy for setting a shared vision and agenda **towards 2050** for the Forest-Based Industries to advance a forest-based circular bioeconomy and address climate change. The group has identified three **focus areas**:

1. Accelerating the development and deployment in Europe of forest-based carbon neutral technologies.
2. Stepping-up markets for the lowest carbon footprint products, delivering tangible environmental and societal benefits.
3. Enhancing access to sustainable raw materials, preserving Europe's resources independence

A set of **horizontal issues** are cross-cutting these focus areas, which are: the availability or further development of science-based data and methodologies, the social dimension and skills agenda for the workforce, as well as awareness-raising and communication in the value chain, with other sectors and the general public.

1.11. Formaldehyde emissions

Around 60% of the formaldehyde used in the EU is used to manufacturing resins, which are used for producing a wide variety of articles for consumers. The primary use of such resins is in the manufacturing of **wood-based panels**, where they act as a bonding agent for wood particles. The main typologies of these wood-based panels are: plywood, particleboard, oriented strand board (OSB), medium density fibreboard (MDF), and other fibreboard (including hardboard and softboard). **Formaldehyde-based resins** are also used in the production of other **wood-based products** (e.g. furniture, flooring and building elements for indoor and outdoor use). The other 40% of the formaldehyde produced and imported in the EU is mainly used in the production of paints for industrial use, in the production of mineral

wool, in the textile and leather industry, and in the production of foams for insulation of buildings and cars.

Studies performed in recent years show that the **formaldehyde released from articles** into indoor air is the primary source of consumers' exposure. The harmonised European standard for wood-based panels used in construction is the **EN 13986**. The test method **EN 717-1** was originally developed to measure formaldehyde emissions from wood-based panels and it is the **reference method** for determining the formaldehyde emission **classes E1 and E2** of wood-based panels defined in EN 13986 standards. However, these standards does not restrict the placing on the market of class E2 wood-based panels, i.e. panels with formaldehyde release >0.124 mg/m^3

In spite of no existing at the moment EU-wide legally binding limit values to protect consumers from articles formaldehyde emissions, since 2007, a **voluntary industry agreement** exists at European level limiting formaldehyde emissions from wood-based panels. Specifically, the members of **the European Panel Federation (EPF)** adopted an internal agreement to produce only class **E1 wood-based panels**.

Currently, eight **EU Member States** – Austria, Denmark, Germany, Greece, Italy, Lithuania, the Netherlands and Sweden – have adopted **national legislations** to limit formaldehyde emissions from wood-based panels. These legally binding emission limits generally correspond to the E1 emission class.

There is a proposal, under **REACH** framework, to restrict the placing on the market or the use of all articles releasing formaldehyde at concentrations greater than or equal to **0.124 mg/m^3**, dated on January 2019.

On the other hand, the European Council, Parliament and Commission agreed to limit the **occupational exposure for formaldehyde at 0.3 ppm** in Annex III of Directive 2004/37/EC. This was achieved on Tuesday, 29th January 2019. The limit value is legally binding and it aims to ensuring better prevention.

In the **United States**, on the 12th of December 2016, **EPA** (Environmental Protection Agency) issued a final rule to reduce the human exposure to emissions of formaldehyde from certain wood products produced within the country or imported. EPA and the **California Air Resources Board (CARB)** worked together to facilitate that the final national rule and the Californian one had consistent requirements when referring to similar composite wood products. These products include: hardwood plywood, medium-density fiberboard, and particleboard, as well as household and other finished goods containing these products. Based on the type of product these formaldehyde emission limits can be different.

They agreed that composite **wood products sold, supplied, offered for sale, manufactured, or imported in the United States**, between 1st og June 2018 and 22nd of March 2019, were required to be labelled as compliant of CARB ATCM Phase II or TSCA Title VI. After March 22, 2019, composite wood products must be labelled as TSCA Title VI compliant. The final rule also established a third-party certification program for laboratory testing.

Some **standards** related to the measurement of formaldehyde emission from wood-based panels and volatile organic compounds (VOCs) are:

Formaldehyde emission standards

- ISO 12460-3: 2015 Wood-based panels. Determination of formaldehyde release. Part 3: Gas analysis method.
- ISO 12460-5: 2015 Wood-based panels. Determination of formaldehyde release. Part 5: Extraction method (called the perforator method).
- ISO 717-1: 2004 Wood-based panels. Determination of formaldehyde release. Part 1: Formaldehyde emission by the chamber method.
- CEN/TS 15119-1: 2018 (WI = 00038205) Durability of wood and wood-based products.
- CR 14244: 2001 (WI = 00038092) Durability of wood and wood-based products.

Standards on volatile organic compounds (VOCs)

- ISO 16000-9:2006. Indoor air. Part 9: Determination of the emission of volatile organic compounds from building products and furnishing. Emission test chamber method. (ISO 16000 -9:2006)
- ISO 16000-9:2006/AC:2008. Indoor air. Part 9: Determination of the emission of volatile organic compounds from building products and furnishing. Emission test chamber method. (ISO 16000-9:2006/Cor 1:2007).
- EN 13999-2:2014. Adhesives. Short term method for measuring the emission properties of low-solvent or solvent-free adhesives after application. Part 2: Determination of volatile organic compounds.
- EN 13999-3:2007+A1:2009. Adhesives. Short term method for measuring the emission properties of low-solvent or solvent-free adhesives after application. Part 3: Determination of volatile aldehydes.
- ISO 13199:2013. Stationary source emissions. Determination of total volatile organic compounds (TVOCs) in waste gases from non-combustion processes. Non-dispersive infrared analyser equipped with catalytic converter.
- ISO 10580:2012. Resilient, textile and laminate floor coverings. Test method for volatile organic compound (VOC) emissions.
- ISO 16000-10:2006. Indoor air. Part 10: Determination of the emission of volatile organic compounds from building products and furnishing. Emission test cell method.
- ISO 16000-11:2006. Indoor air. Part 11: Determination of the emission of volatile organic compounds from building products and furnishing. Sampling, storage of samples and preparation of test specimens.

1.12. The Timber Regulation or EUTR

The Regulation (EU) No 995/2010 of the European Parliament and of the Council of 20 October 2010 defines the obligations of operators selling or distributing **timber and timber products**. It is known as the EU Timber Regulation or EUTR, too. It tries to fight the trade of timber illegally harvested and timber products by three key obligations:

1. For the first time, it forbids the sale in the EU market of illegally harvested timber and products produced with such timber;
2. It requires EU traders to exercise 'due diligence' when they sale timber products;
3. Keep records of their suppliers and customers.

The Regulation relates to a **wide typology of timber products** among which we find: solid wood products, flooring, plywood, pulp and paper. It does not include recycled products, as well as printed papers such as books, magazines and newspapers. It foresees that the list of products can be revised if needed.

The Regulation entered into application on the 3rd of March 2013 and it is legally binding for all 28 EU Member States, which are responsible for enforcing the regulation and to identify and apply it effective, proportionate and dissuasive penalties. It **applies to both imported and domestically produced timber and timber products**, which, when covered by valid **FLEGT** or **CITES** licenses, are considered fulfilling the EUTR requirements.

The EU implemented a **voluntary scheme** called the **FLEGT Action Plan** to guarantee the timber imported to the EU is legally harvested in those countries that take part in this scheme. The EU **FLEGT Regulation** was adopted in December 2005, and a 2008 Implementing Regulation, and it defines the legal framework to control of the EU timber imports from countries that signed bilateral FLEGT Voluntary Partnership Agreements (VPA) with the EU.

In order to protect and do not threat a variety of more than 30.000 wild animals and plants with different degrees of protection, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (**CITES**) was signed in 1973. It **protects the international trade of a variety of animals and plants**. It requires that the trade of these selected species is kept under control. It includes the requirement of having a specific licence that authorizes the import and export of the species covered by this convention.

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Module 2, Unit 4

UNIT 2.4

VOLUNTARY TRANSITION INSTRUMENTS

Objective of the unit	The objective of the unit is to understand the available voluntary instruments to facilitate and succeed in the transition to a circular economy
Learning outcomes	Knowledge: Recognize the basic characteristics of the Circular Economy main voluntary instruments that can be adopted in the Furniture sector. Skills: Analyse the main outputs and consequences of these voluntary instruments and recognize how they can be applied and employed. Competences: Select and deploy the most relevant voluntary instruments within the Company in the framework of its Circular Economy strategy.
Pedagogical approach	PowerPoint Infographic Reading materials (not compulsory)
Hours	3 hours
Assessment methodology	Quiz (at the endo of the module)
ECVET	0,12 credits (0,46 the complete module)

Content

1. VOLUNTARY INSTRUMENTS TO CIRCULARITY

The following voluntary instruments can be a force to introduce circularity in the furniture sector.

1.1. Green Public Procurement (GPP)

Europe's public authorities consume many and different goods and services. They have a relevant **purchasing power** and they can clearly and strongly support sustainable consumption and production (Green Public Procurement or green purchasing), if they choose **environmentally friendly goods, services and works**.

In spite being a **voluntary instrument**, GPP can make a difference in the EU's efforts to become a more resource-efficient economy. It can foster the creation of a **critical demand mass** of more sustainable goods and services, which otherwise would not be easy to get onto the market. For these reasons, GPP is a strong **stimulus for eco-innovation**.

We speak about green public procurement when **environmental criteria** are incorporated in the **specifications of a public tender**. Thus, green public procurement refers to “a process by which public authorities seek to purchase goods, services and works with a reduced **environmental impact during their life cycle**, compared to goods, services and works with the same function". Green public procurement therefore involves the integration of the environmental components into public procurement decisions.

In other words, it means choosing products according to their content, their packaging, their recyclability, the waste they can generate and many other environmental aspects, such as whether they are or not in possession of an ecolabel.

Green purchasing involves learning about all the ways in which a product can affect the environment during its life cycle: from the materials used for its manufacturing, the way to use it, till to its disposal or re-use. In this framework, GPP will foster companies making responsible and intelligent decisions.

The European Commission aims to ensure that **50% of all public tender procedures include environmental criteria**, so it is essential for companies to know and anticipate the new green requirements established for each sector.

The European Commission and several EU countries have prepared different **guidelines** for GPP processes, in the form of national GPP criteria. The challenge is to foster more public sector bodies to adopt these criteria so that GPP becomes a more common practice. One relevant challenge is ensuring that different EU countries require green purchasing requirements that are somehow compatible. The following table shows the situation of GPP policies in different countries[10].

[10] *Source: JRC - 2017*

Table 5: Situation of GPP policies in different countries

Direct recommendation of EU GPP criteria	Development of specific national GPP criteria	No recommendation of any GPP criteria
Belgium	Austria	Bulgaria
Cyprus	Czech Republic	Croatia
Denmark	Finland (under development)	Estonia
Latvia	France	Greece
Poland	Germany	Ireland
Slovakia	Italy	Hungary
Slovenia	Lithuania	Luxemburg
	Malta	Portugal
	Netherlands	Romania
	Norway	
	Spain	
	Sweden	
	UK	

EU studies found that the purchasing of **office furniture** by the public sector represents **15% of the EU market**. For example, government procurement (excluding wider public sector) in the UK represents approximately 10% of the office furniture market.

The updated **EU GPP criteria for furniture** has been published in August 2017, an updating process carried out in alignment with the revision of the **EU Ecolabel criteria** for the same product group. A summary of the environmental criteria for office furniture is presented hereafter:

At **raw materials** level:

- The origin of wood from sustainably managed forests.
- The inclusion of a fraction of recycled material in metals and plastics.
- Environmental improvement measures in fabrics and foams.
- The levels of formaldehyde emissions in particleboard and fibreboard.
- Emissions of volatile organic compounds in paints and varnishes.
- During the manufacturing, the non-use of chemicals processes classified as carcinogenic, harmful to the reproductive system, toxic or allergenic (when inhaled).

At the **product** level:

- The maximum durability of the furniture.
- The easy and correct maintenance of the furniture.
- The dismantling of the product at the end of its useful life.
- The packaging material and its correct removal and final management.

Green public procurement, therefore, is a tool that offers clear advantages for administrations and their suppliers in different ways:

- It makes significant environmental improvements.
- It improves the image of organisations and companies.
- It stimulates the competitiveness of companies in the private sector.

For more information about GPP visit the web:
http://ec.europa.eu/environment/gpp/index_en.htm

Additionally, you can visit the **GPP-FURNITURE project** (http://www.gpp-furniture.eu). It is an innovative and open learning resource for professionals of the furniture industry to expand their knowledge and provide added value for the Green Public Procurement.

1.2. Environmental Management Systems (EMS) in organizations

An environmental management system supports organizations and companies to identify, manage, monitor and control their environmental critical aspects and performances in a "holistic" manner.

There are two main certified Environmental Management Systems implemented in the EU, which are EMAS and the ISO-14001:2015.

The **EU Eco-Management and Audit Scheme (EMAS)** was designed and spread by the **European Commission** as a high standard management system for companies and other organisations to evaluate, report, and improve their environmental performance. EMAS is available for every type of organisation willing to improve its environmental performance. It can cover all economic and service sectors and it is applicable worldwide. Since the revision of the annexes of the EMAS Regulation, it is easier for an organisation already complying to an environmental management system such as ISO 14001 to step up to EMAS.

For more information visit: http://ec.europa.eu/environment/emas/index_en.htm

The main environmental management system used worldwide is the **ISO 14001,** which sets out the requirement of this **internationally agreed standard**. It can be used by all types and dimension of private, governmental or not-for-profit entities. It requires that an organization adopting its standards analyse all its environmental matters and aspects that exist within its processes and functioning.

In **2015 a revision** of the standard was done. Some key improvements were implemented such as the increased importance of environmental management in the organization's strategic planning processes, greater role and contributions from leadership and a stronger commitment to increase proactive initiatives improving environmental performance, as well as a **more life cycle thinking approach**.

For more information visit: https://www.iso.org/obp/ui#iso:std:iso:14001:ed-3:v1:en

You can find more information about these environmental management systems in the Module 5 of this Course.

1.3. Ecodesign

The Ecodesign main purpose is to reduce to a minimum level the product or service overall environmental impact. It focuses the attention on **innovative design solutions** for both products and services, while taking into account the **entire lifecycle** – from the extraction/origin of raw materials to production, distribution and use – all the way to recycling, "reparability", and disposal.

Ecodesign initiatives, mandatory and voluntary, can help significantly in terms of life extension, both directly, and indirectly, by enabling repair and remanufacturing.

For more information about Ecodesign read the "**Module 5**" of this course.

1.4. Ecolabels

There are several types of ecolabels and they are classified in three main types, regulated under de ISO 14020 - Environmental labels and declarations. General principles series:

- ISO 14024. Environmental labels and declarations. **Type I** environmental labelling. Principles and procedures.
- ISO 14021. Environmental labels and declarations. Self-declared environmental claims (**Type II** environmental labelling).
- ISO 14025. Environmental labels and declarations. **Type III** environmental declarations.

Ecolabelling of **type I** is based on the evaluation of several criteria of life cycle by a third party, which grants a licence justifying the use of ecolabels with products of a particular product group.

Ecolabelling of **type II** is a self-declaration of environmental predication by producer, importer, distributor, retailer or anybody who benefits from the predication. In this case, this declaration is not certified or approved by a third party.

Ecolabelling of **type III**, called Environmental Labels and Declarations (ELD) need to be based on the evaluation of the product life cycle (LCA). It needs to be certified by an impartial third party.

The most well-known ecolabels for furniture are the following:

TYPE I LABEL EXAMPLES			
European Ecolabel (Europe)	Nordic swan (Nordic countries)	Blue angel (Germany)	French ecolabel (France)

SEMI TYPE I LABEL EXAMPLES	
Chain of custody Certification (Standards by country)	Chain of Custody Certification (Standards by country)

TYPE II LABEL EXAMPLES
Recyclability / Recycled material content

TYPE III LABEL EXAMPLES	
EPD	The Sweden-based "international EPD Consortium" manages the system. It was created in order to be the default international system regarding the development and certification of EPD. The EPD format can be used around the globe. http://www.environdec.com

Figure 9: The most well-known ecolabels for furniture

For more information about ecolabels read the "**Module 5**" of this course.

1.5. Chain of custody

The Chain of Custody refers to the **continuous path** that products raw materials and parts take **from the forest to the final consumer**, including manufacturing, transportation and distribution all stages.

There are currently two independently accredited chain of custody programmes operating in the Timber Industry: The **FSC (Forest Stewardship Council)** scheme and the **PEFC (Programme for the Endorsement of Forest Certification)** scheme. Some other National schemes also exist, but with less extend.

Timber supply Chain of Custody certification provides evidence that the certified product originates from certified, well managed forests. It verifies and ensures that these products are not mixed with other products from no-certified forests at any point along the supply chain, except under strict controls when percentage (%) labelling is being used.

For more information about Chain of custody read the "**Module 5**" of this course.

1.6. Green building certification

The construction and functioning of buildings have strong direct and indirect impacts on the environment. During their construction, occupancy, renovation, repurposing, and demolition, buildings use directly or indirectly energy, water and raw materials; they generate waste, and emit potentially harmful atmospheric emissions. This condition motivated the creation of **green building standards, certifications, and rating systems** aimed to reducing environmental impacts of buildings on the environment by a more efficient sustainable design.

These standards **do not affect** directly the **furniture or habitat products**, but the use of renewable o less harmful materials for these products can improve the rating of the building. Therefore, the interest to obtain this type of standards for buildings can imply the demand of more sustainable products in the furniture or habitat sector.

The push toward sustainable building design increased in the 1990s with the creation of **Building Research Establishment's Environmental Assessment Method (BREEAM)**, the first green building rating system in the U.K. In 2000, the U.S. Green Building Council (USGBC) followed suit and prepared and delivered criteria aiming to improve buildings environmental performance through its **Leadership in Energy and Environmental Design (LEED)** rating system for new construction.

There are other "green building certifications" but these two are the most extended.

Building Research Establishment Environmental Assessment Method (BREEAM) - https://www.breeam.com

BREEAM is an **international scheme** that provides a **certification by an independent third party** for the assessment of the sustainability performance of individual buildings, communities and infrastructure projects.

BREEAM ratings are required by many governmental entities and there are currently over 100,000 BREEAM-rated buildings.

Assessment and certification can take place at different stages in the building environmental life cycle, from design and construction through to operation and refurbishment.

In BREEAM scheme, third-party certification require the control, by objective experts, of the assessment done by a qualified and licensed BREEAM Assessor of a building or its project to secure that it meets the quality and performance standards of the scheme. **Certification bodies** play a key role in this process – organisations that have be approved by governmental accreditation bodies and thus authorized to certificate products, systems and services.

A certified BREEAM assessment delivers a certified rating that reflects the quality of the performance achieved by a project and its stakeholders, as measured against the standard and its benchmarks. The **BREEAM ratings,** presented with a different number of stars, **range** from Acceptable (In-Use scheme only) to Pass, Good, Very Good, Excellent to Outstanding.

BREEAM evaluates the **sustainable value for different categories**, ranging from energy to ecology. Each of these categories addresses the most influential factors, including low impact design and carbon emissions reduction; design durability and resilience; adaption to climate change; and ecological value and biodiversity protection. **Materials** are one of these categories

and it encourages any action to reduce the impact of construction materials through design, focusing on the materials procurement that should be purchased in a responsible way and have a low embodied impact over their life cycle.

Leadership in Energy and Environmental Design (LEED) - https://new.usgbc.org/leed

Leadership in Energy and Environmental Design (LEED)—was created in 2000 by the **U.S. Green Building Council** (USGBC). Its aim is to rate design and construction practices defining a green building. LEED is used throughout North America as well as in more than 30 countries with over 90,000 projects using LEED.

LEED analysis focus on **7 different categories** and assign to each of these a certain level of credits, they are: Site Selection, Water Efficiency, Energy and Atmosphere, **Materials and Resources**, Indoor Environmental Quality, Regional Priority, and Innovation in Design. The sum of the different categories can reach maximum 100 points, but it establish as well some compulsory prerequisites such as minimum energy and water-use reduction, recycling collection, and tobacco smoke control. Within each category **specific credits** are given to specific sustainable strategies, such as the use of low-emitting products, reduced water consumption, energy efficiency, access to public transportation, **recycled content**, renewable energy, and daylighting.

The LEED **certification process** can be done **Online**. Project teams are required to collect specific documentation to demonstrate the compliance of the building with LEED requirements and upload this documentation to the LEED Online website. The documentation is then checked and evaluated by the Green Building Certification Institute (GBCI); a LEED certification is delivered if all prerequisites and a sufficient number of credits are obtained by the project.

There are **four levels of LEED certification**: Certified, Silver, Gold, and Platinum. On-site visits are not required and certification can be achieved after the building completion.

Here are four different **LEED credits** that you can obtain when you install **sustainable furniture** in the building.

Materials Reuse: MR Credit 3.1 and 3.2
Regional Materials: MR Credit 5.1 and 5.2
Recycled Content: MR Credit 4.1 & 4.2
Certified Wood: MR Credit 7

UNIT 2.5

CASE STUDIES

Objective of the unit	The aim of the unit is to know successful and inspiring experiences of other companies.
Learning outcomes	Knowledge: Be aware of good practices of Circular economy within the European Furniture sector. Skills: Recognize the specific and distinguishing features and keys to success of these case studies. Competences: Select, transfer, create and deploy new strategies for implementing the Circular Economy within the company
Pedagogical approach	PowerPoint Reading materials (not compulsory)
Hours	2 hours
Assessment methodology	Quiz (at the end of the module)
ECVET	0,08 credits (0,46 the complete module)

Content

1. CASE STUDIES

This Unit presents different Case Studies of different organisations which have applied some of the Legislative or Voluntary Instruments described in the previous Units. The objective is to show how these instruments have been put in practice in different EU countries.

1.1. LEGISLATIVE INSTRUMENTS

1.1.1. Circular Economy Action Plan

Preparation for Reuse Targets, Spain

Spain is the first European country to set a **mandatory national reuse target**. The Spanish Waste Plan 2016-22 sets a 50% target for waste to be recycled or prepared for re-use. In this framework, **2% of all furniture**, textiles, electricals, and other suitable goods, must be redirected from recycling or landfill and sent **for repair and resale**.

Spain aims also to support the social sector with the Spanish Waste Plan which foresees that the social sector should receive preferential access to municipal waste collection points to allow them to exploit these goods.

Circular Economy Investment Fund, Scotland

The Scottish Government aims to deliver a circular economy for Scotland. The Government committed itself to move towards a more circular economy within its **national waste strategy**, 'Making Things Last' (with similar commitments enshrined within Scotland's national economic strategy**). Scotland's Zero Waste Plan** has been developed, and it was delivered in partnership with Zero Waste Scotland, enterprise agencies and the environmental regulator, SEPA, and with other actors such as local authorities. Delivery is supported by over £70M of investment, including a **Circular Economy Capital Investment Fund** to increase the skills and competences related to the reuse, repair and remanufacturing sector across Scotland.

Tax Breaks for Repair, Sweden

The Swedish Government is seeking to introduce **tax breaks on the repair of household items**, **including furniture**, to stimulate the development of a new home repair industry. The Government recently submitted proposals to parliament to **cut the VAT rate** on repairs to household products **from 25% to 12%.** Proposals are intended to lower the cost of repair, and in doing so, to drive consumers to consider the repair of household items before instantly replacing items with new ones.

1.1.2. Extended Producer Responsibility (EPR) schemes

EPR for Furniture in France

In France, furniture at the end-of-life is managed according to the EPR regulation. Different schemes are in place for domestic and commercial furniture which are managed and operated by Eco-Mobilier and Valdelia, respectively. The main objectives of the French EPR are:

- Reducing the waste furniture sent to landfill;
- Achieving a 45% recycling/reuse target; and
- Stimulate furniture manufacturers to adopt ecodesign principles.

In 2013, €80M was collected **via levies** to financially support the domestic scheme. They were paid by furniture producers, retailers and importers, to cover the cost of collection, logistics, infrastructure and R&D into new markets for recovered materials. In 2015 the positive result was that the domestic EPR scheme collected **0.85M tonnes of domestic furniture**, resulting in a **55% of recycling and 86% of recovery rate**.

In 2006 in the framework of the French EPR scheme, **Eco Modulation Criteria** were created for the new furniture sold in the market. A **lower levy** is charged to manufacturers, when they meet environmental product criteria. This is a simple essential criterion, which allows that the process is 'controllable' and not too difficult to manage. This covers products which are:

- Manufactured 95% of metal, no padding (easy to recycle)
- Manufactured from 95% made of wood, sourced from sustainable forests (easy to recycle)
- Products designed for babies / children which can be adapted to the growth of their user – e.g. furniture for children (cots which convert to beds/chairs, designed for growth)

Eco-modulation criteria have to be adopted in order to guarantee that by 2017 at least a minimum of 3% of furniture can be eco-modulated. To push them to design products according recycling criteria, when companies comply with these criteria, they pay a lower levy, with a fee reduction surrounding the 20%.

1.1.3. REACH Regulation

Bed Factory - Sweden (http://www.bedfactorysweden.com)

According to company website, the materials and components which are used for their beds are purchased from the leading and most renowned suppliers in Europe. They look for proven performance as well as reliability. In order to maintain their high standards they continuously test and measure the quality. Their materials and operations are certified by:

- OEKO-text
- Forest Stewardship Council
- ISO 9001:2015
- CE-marking
- UK Furniture and Furnishings (Fire) (Safety) regulations (1988)
- Svanen – Nordic Eco Label
- **REACH**

1.1.4. Ecodesign Directive

Ecodesign Requirements for Textiles and Furniture

The **Nordic Council of Ministers** funded a project in order to demonstrate how resources related to **ecodesign requirements** can be defined also for non-energy-related products, using textiles as an example, and they applied a 'lighter application' to the **furniture sector**. They chose clothing and home textiles as these, along their value chain, significantly squander resources due to fast fashion, dropping quality and relatively low repair and reuse rates.

The proposed **potential requirements for furniture** were:

- Fitness for use
- Expected lifespan
- Packaging materials
- Provision of spare parts
- Design for disassembly
- Consumer information/instructions
- Bill of materials

For more information visit: https://www.norden.org/en/publication/potential-ecodesign-requirements-textiles-and-furniture

1.1.5. Flame retardants

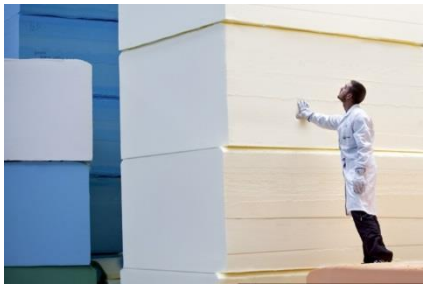
Some companies are working for reducing the use of flame retardants in furniture.

For example, **Dow Chemical** has introduced **VORAGUARD™** —a novel Polyurethane Polyols that provide manufacturers of **flexible polyurethane foams** for furniture, bedding and seating applications with a powerful solution to increase comfort levels and ease regulatory compliance, all while reducing raw material components and simplifying foam processing and storage.

VORAGUARD is a patented polymer polyol for **combustion modified high resilience** (CMHR) slab-tock foams, based on polyisocyanate polyaddition (PIPA) technology. It was designed to meet the most severe, high-ignition source flammability tests—such as BS 5852, Crib 5 in the United Kingdom and California TB133—where the flame temperatures are high and the ignition is applied for a long time.

Other manufacturers are offering furniture products with high characteristics regarding flammability. Hereafter are shown some examples:

INTERPLASP - Spain (http://interplasp.com/)



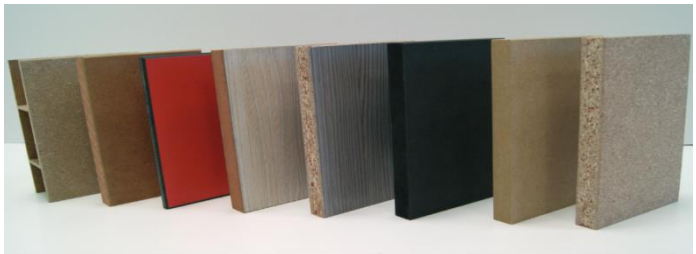
Interplasp is one of the best European flexible polyurethane foam manufacturers characterized by a strong technological base and high load of innovation. Interplasp, in collaboration with CETEM, has worked in different projects with the objective of analysing the **improvement of the flammability reaction of flexible polyurethane foam through the addition of nanoparticles.** Due to the results of the different projects, Interplasp currently offers among its products the "contact BS" type of foam.

This material has been subjected to reaction-to-fire testing based on “British legislation Consumer Protection” standard BS 5892, regarding the flammability of upholstery furniture. The results of these tests were deemed satisfactory and comply with British legislation.

FINSA - Spain (https://www.finsa.com)

FINSA is a pioneer in the manufacturing of **particleboard and MDF** in the Iberian Peninsula, with commercial offices and factories in more than 8 EU countries. FINSA has developed a strong research on particleboards and MDF with **low flammability level** that fulfils the standard UNE EN 13501 “Fire classification of construction products and building elements”. Fire retardant boards, developed thanks to the use of **special materials and coatings**, are especially recommended for those public places where an improved reaction to fire is needed (e.g. hotels, hospitals, public buildings, etc.). Thus, currently it is possible to find among its products the following ones:

- Fibraplast fire retardant - an MDF board with a low degree of flammability.



- Fibrapan fire retardant - made of selected wood fibres (MDF). They have a low flammability degree.

- Fimapan fire retardant - a wooden chipboard with a low degree of flammability

Moreover, FINSA has launched its own production line **for laminate floors** fire retardantsbased on similar materials.

Lualdi - Italy (https://www.lualdiporte.com/en)

Lualdi is one of the most relevant Italian enterprises in the design sector, concretely for interior doors, custom-made furniture and mill work, both residential and contract. Lualdi has carried out a project with CETEM whose aim was to produce door and panels made of **eco-friendly materials based on vegetable oils, mineral fillers and vegetable fibres instead of synthetic material**. This product has been subjected to fire resistance testing based on standard UNE EN 1634-1: "Fire resistance and smoke control tests for door and shutter assemblies, open windows and elements of building hardware". The product passed all the tests and it obtained the EI20 certification. This is due thanks to the multi-layer structure used in its design, and the selection of new eco-friendly materials with **fire resistance properties**.

1.1.6. Renewable Energy Directive

There are several companies that work on using **wood waste to produce energy**. An example is Ashwell Biomass (UK), biomass specialists with over 100 years of experience in solid fuel handling, who develop a wood waste to energy solution (https://www.ashwellbiomass.com).

Converting wood waste into energy enables companies that produce or have access to enough quantities of wood waste material to use this as fuel for a proven biomass boiler and feed system, which **generates heat and hot water** (or steam/thermal oil). This will minimize disposal costs and generate Renewable Heat Incentive (RHI) income.

The boiler is sized to take into account the volume of waste wood and heat demand. The system is very easily connected/integrated into the existing system thus vastly reducing or eliminating the existing fossil fuel bills. The system can run solely on chipped wood waste or on standard specification wood chip for those sites that have a heating requirement larger than the amount of waste wood generated.

1.2. VOLUNTARY INSTRUMENTS

1.2.1. Cascading use of wood

L'Estoc - Spain (http://lestoc.com/)

L'Estoc designs, produces, and sells **furniture made from recycled materials and disused objects**. Its goal is to improve and dignify the life of people with intellectual disabilities, fostering development through work. The combination of materials is the house trademark: From wooden blinds the company makes benches or screens, a door can become a table, and a crib is turned into a child desk.

1.2.2. Environmental Management Systems

Figueras International Seating - Spain (https://www.figueras.com)

The Figueras Group is the global specialist in the design and manufacturing of high-end fixed seating and movable seating solutions for public spaces, crafted through design, innovation and engineering since 1929.

Figueras wants to make a significant contribution to improving the environment and believes in ecodesign and taking a sustainable approach to manufacturing. This is why the company has **complied with ISO 14001**, the global, officially-recognized, voluntary standard that certifies Figueras' exemplary environmental performance.

In 2017, Figueras Seating also obtained certification, in accordance with international standard **UNE-EN ISO 14006**. This certification applies to **product design** and encompasses environmental aspects such as the integration of product sustainable materials, eco-friendly production processes, non-toxic materials use, etc. All of them take into consideration the complete lifecycle of the products.

1.2.3. Ecodesign

Gispen - The Netherlands (https://www.gispen.com/en/#)

As a designer and producer of office furniture, Gispen's business model is built upon **circular economy principles**, with a special attention on well-designed durable products, long service life and optimum use. Post installation, Gispen also offers **reverse logistics for furniture**, and furniture updating and reconfiguring services, as office furniture requirements for office spaces proper evolution.

Whilst principally focused around design and manufacturer, Gispen's business model has shifted towards **delivering facility management services** to its customers. The approach to design and supply of circular furniture products follows guiding principles, including sustainable material selection, disassembly potential, maintenance and upgradability, and recyclability.

Gispen provides a variety of **financing models** to its customers which includes pay-per-use. Under this business model, Gispen retains the products ownership, with different contracts depending on the deployment and use of the furniture. The amount that customers pay is reflected in the number of workstations required, functional and aesthetic needs, and the period of use / intensity of usage.

1.2.4. Green Public Procurement

Procurement of refurbished school furniture in Aalborg - Denmark

School furniture needs to be replaced periodically, though it is often an expensive process for schools to invest in new furniture and learning environments. In 2017, Aalborg Municipality launched an ambitious project aimed at **refurbishing and recycling of the old school furniture**

for the benefit of both the schools' budget and the environment. As part of the market dialogue, the city had 7 meetings with suppliers to determine and prepare them for **circular procurement criteria**. As minimum criteria to ensure circularity the municipality used the following:

- 5 years warranty on lifetime of new furniture
- 2 years warranty on lifetime of refurbished furniture
- 5 years warranty on spare parts
- Packaging has to be recyclable (paper, wood etc.)
- Plastic parts above 50 grams have to be labelled for recycling
- 70 % of used wood has to be sustainable e.g. FSC, PFFC or reused wood
- New and refurbished furniture have to be labelled with supplier logo

As part of the award criteria circularity accounted for 40 % and was based on **lifetime** (30 %), **service and maintenance** (25 %), **reuse** (20 %), **refurbishment** (15 %) and material **recycling** (10 %).

Several suppliers responded to the assignment with creative offers that impressed the municipality, as circular economy is a fairly new way of thinking. The contract has been awarded to Højer Furniture (http://hojermobler.dk/en/).

Procuring sustainable furniture - Denmark [11]

The **National Procurement Ltd**., SKI, a central procurement organisation that brings together public purchasers and suppliers by establishing large framework contracts, and which aims to promote efficient public purchasing in Denmark, launched in 2012 a tender to establish a four-year framework contract between more than **60 municipalities** and a supplier of sustainable office furniture. The tender included **strict environmental and quality requirements**. Special attention was given to the presentation of appropriate documentation for all environmental aspects of production and final products, in order to assure municipalities that the furniture purchased through the joint procurement met the environmental criteria required.

The following **requirements** were included to address environmental and occupational health issues:

- Absence of undesirable chemical substances as listed in the "List of undesirable substances 2009" from the Danish Environmental Protection Agency.
- Fulfilment of certain environmental requirements covered by, among others, "the Nordic (Swan)" ecolabel.
- Furniture or furnishings labelled with the **Swan ecolabel**, or an equivalent means of proof, were accepted as means for complying with the following requirements:
    - Wood and wood-based materials used in goods and supplies must be made of legally harvested timber.
    - At least 70% of the wood must be either recycled or verifiably sustainable timber products.

[11] Source: http://ec.europa.eu/environment/gpp/pdf/news_alert/Issue58_Case_Study118_sustainable_furniture_Denmark.pdf

- Ensure that generated odours do not cause discomfort for the users and meet the requirements of the Danish Indoor Climate label, or equivalent.

Finally, in 2012, among five bidders, the contract was awarded to a single supplier for a period of four years. The expected turnover of this agreement is more than €27M. Currently, 67 municipalities are using it and are purchasing mainly office chairs and office desks. Through the framework agreement, municipalities are ensured that the minimum requirements for environmental conditions are met.

Reusing and refurbishing furniture in a new office - United Kingdom[12]

Public Health Wales (PHW) is a statutory body, established in 2009, which aims to improve public health and well-being and reduce health inequalities in Wales. In 2016 the organisation **relocated from nine smaller satellite offices to a new larger 4,700m^2 open-plan office**. It decided to use this move as an opportunity to embed the core principles of 'sustainability' and 'maximising public value' in the new office, and created a vision for a space which encouraged collaboration, socialisation, focus and learning.

Moving to a new office space normally results in the need to purchase new furniture. However, PHW recognised that they already owned a large amount of quality furniture and fittings, and that with some cleaning, refurbishment and redesign; these items could be repurposed and combined with other new or re-used furniture in a cohesive and functional style appropriate for the new office space. As such, PHW decided to adopt a new mind set when procuring for the design and supply of office furniture, equipment and floorings, and looked for suppliers who could **reuse as much of the existing items as possible**.

The **specifications** were developed to deal with different key issues and aspects, such as follows:

- The need for a design which would meet collaborative workspace requirements.
- The need to re-use as much of the existing furniture as possible and augment this with pre-owned items, with new furniture being the least favoured option. For that aim, an 'Inventory of Current Furniture' was included in the tender specification.
- Where new timber and wood-derived products for supply or use in performance of the contract were necessary, it was specified that materials must come from a verifiably legal and sustainable source.
- The supplier was required to specify items with coatings and whether these utilised hazardous chemicals, to prefer more environmental friendly products, or more environmental friendly lubricants.
- Packaging was also specifically targeted in terms of reduction and recycling.
- A commitment to deliver community benefits was also included to ensure that wider social and economic issues were taken into account when spending public money. This included a need to consider opportunities to recruit and train persons from disadvantaged groups.

The final value of the contract was €459,657. A total of eight tenders were submitted, including two from SMEs. The winning bid, awarded in June 2016, was from a consortium which included a sustainable office design service, a furniture manufacturer and a community interest company, with specific objectives to support low-income and long-term unemployed people in areas of high social deprivation. The consortium successfully developed new ways of

[12] Source: http://ec.europa.eu/environment/gpp/pdf/news_alert/Issue77_Case_Study_152_Wales.pdf

working, met the ambitions of the tender and avoided waste, and created additional greater public value by creating training and meaningful employment opportunities.

Finally, out of the 2.563 items used in the new office:

- 45% of items were re-used
- 49% of items were remanufactured
- **Only 6% of items were sourced from new stock**

1.2.5. Ecolabels

Blue Angel

Brühl - Germany (https://bruehl.com/)

Brühl was the first furniture manufacturer in Germany to be awarded with the **"Blue Angel"** ecolabel for particular eco-friendliness so it has been the first German seating furniture manufacturer to be entitled to use the 'Blue Angel' label in 2009. Brühl has also been a certified carbon neutral manufacturer since 2017.

Nordic Ecolabel

About 46 companies and 879 products for furniture sector (http://www.svanen.se/en/Criteria/Nordic-Ecolabel-criteria/Criteria/?productGroupID=18)

Edsbyn - Sweden (https://www.edsbyn.com/)

Edsbyn was the first manufacturer of office furniture to have its products **Nordic Ecolabelled**. Its latest example of a Nordic Ecolabelled product is the EASE screen system which is manufactured from a material normally used for sound absorption in vehicles. It primarily consists of recycled textiles and PET bottles, which makes EASE a good example of sustainable product development.

1.2.6. Chain of custody

There are many furniture manufacturers that certify the origin of the wood used in their production processes. Here after, some examples are presented:

JYSK - United Kingdom (https://jysk.co.uk)

Garden furniture is one of JYSK's core areas and they are among Europe's largest retailers of garden furniture. They work actively to fight unsustainable and illegal logging and burning. Since 1990 JYSK has worked to increase its share of garden furniture produced from FSC®-certified wood. Today, **all of its wooden garden furniture is FSC-labelled**.

Tvilum - Denmark (http://www.tvilum.com)

Tvilum, is one of the world's foremost producers of do-it-yourself assembly, flat-pack furniture. In 2006, the company became certified with the **PEFC standard**. Today, 99% of the products sold by Tvilum are PEFC-certified; the company applies the percentage-based calculation to its products and is able to claim unreservedly that 70% of the wood and wood-based raw materials in its products are from sustainably managed sources. The company has also achieved **PEFC Chain of Custody certification** which offers guarantees about the traceability of all products components and finally the product itself.

1.2.7. Green building certification

Several furniture manufacturers and distributors show in their websites the possible benefits of using their products in relation to the **LEED certification in buildings**. This is more relevant in the US and Canada, rather than in Europe. Some examples are:

- http://capefurniture.net/environmental/
- https://www.envirotechoffice.com/office-furniture-leed-credits/
- https://www.gunlocke.com/eco-commitment/leed-contributions
- https://specfurniture.com/environment/leed
- https://www.darran.com/leed
- http://www.dcifurn.com/blog/article/earn-leed-credits-dci-furniture

Formica® Laminates are applied as a decorative surface to cladding, cabinets, furniture and fixtures, partitions and worktops, among other elements.

As a component material, Formica Laminates (http://www.formica.com/) may contribute toward **BREEAM credit** for building certification in some points:

- HEA02 Indoor Air Quality.
- MAT1 Life Cycle.
- MAT03 Responsible Sourcing of Materials.
- WST02 Recycled Aggregates.

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