European Commission

Preparatory study on ecodesign for furniture

Phase I
Task 0: Preliminary mapping of available LCA data

Draft Report
Version 1

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Abbreviations

BoM	bill of materials
EPD	environmental product declaration
EoL	end-of-life
GWP	global warming potential
HDF	high density fibreboard
LCA	life cycle analysis
LCI	life cycle Inventory
MDF	medium censity fibreboard
MDP	medium density particleboard
MEErP	methodology for the ecodesign of energy-related products
PEF	product environmental footprint
PEFCR	product environmental footprint category rules
VOC	volatile organic compounds

1. Executive summary

The preliminary mapping of available life cycle assessment (LCA) data represents Sub-task 2.1 of Phase I of the preparatory study on furniture, and corresponds to the optional Task 0 – Quick Scan of the JRC methodology (Torres et al., 2025). Its purpose is to provide an early evidence base for the environmental assessment of furniture and, in particular, to support the definition and modelling of representative base cases in the methodology for the ecodesign of energy related products (MEErP) Task 5.

The analysis has a three-fold purpose: to identify the main environmental hotspots associated with furniture products, components and processes; to assess the availability and potential usability of quantitative inventory data for the modelling of representative furniture base cases; and to identify the main knowledge gaps and additional data collection needs to be addressed in the following stages of the preparatory study.

The mapping started out by the Technical Report that supports the current EU Ecolabel criteria for furniture (Donatello et al., 2017), expanded with different sources of LCA studies and data. The scientific literature review focused mainly on studies published after the review by Cordella and Hidalgo (2016), while considering earlier publications where they provide inventories or evidence that is still relevant. Overall, 28 publications were identified, whose relevance was assessed using the screening approach developed by Cordella and Hidalgo (2016), considering the scope of the study, data quality and representativeness, impact assessment methods, relevance of the findings, robustness and independent review. The approach has been applied with a certain degree of flexibility: where findings from articles that were scored below the threshold were also confirmed in publications with higher scores, these have been considered for the analysis. Twenty-two publications reached the screening threshold and were taken forward for the main analysis.

The scientific evidence was complemented by an analysis of environmental product declarations (EPDs), life cycle inventory (LCI) databases and selected public research initiatives. In particular, EPDs provide complementary information to the scientific LCA literature by broadening the evidence on the material composition of furniture products currently placed on the market and supporting the development and validation of preliminary bill of materials, although the available declarations cannot be considered statistically representative of the EU market. No furniture-specific product environmental footprint category rules (PEFCR) or PEF-compliant studies were identified for the preliminary mapping. Overall 203 EPDs were analysed, including 55 declarations for storage products, 71 for tables and 77 for seating. Beds and miscellaneous furniture were not sufficiently represented to support the same level of quantitative analysis. The available EPD information was harmonised into a common material taxonomy and used to develop preliminary product clusters and average Bills of Materials (BoMs).

The literature (including both scientific literature and EPDs) covers mainly indoor furniture, including seating, desks and tables, storage furniture and wood-based panels, while no sufficiently robust evidence was identified for outdoor furniture,

children's furniture and multifunctional furniture, and also smart devices used within furniture. Wood and wood-based panels are the most frequently represented structural materials, together with steel and aluminium. Upholstered furniture additionally includes polyurethane foam, textiles, leather or synthetic leather, while adhesives, resins, coatings, plastics (e.g., polyethylene, polypropylene, polyamide, polyoxymethylene), fittings and other ancillary materials are represented with different levels of detail. The more recent product information also indicates a broader material diversity that is not reflected in the literature. In particular, plastics can account for a substantial share of the mass of office and contract seating, while composites, glass, mineral materials and electrical and electronic components occur in current products, together with bamboo, rattan, cork and other materials.

The analysis of environmental hotspots confirms the conclusions of Cordella and Hidalgo (2016). The production and supply of materials is the most important life cycle stage, although its contribution varies according to the product configuration and materials used. For wood-based panels, the results indicate that the environmental profile is affected not only by wood supply but also by resins and by energy-intensive production processes. Fibre or chip preparation, drying, pressing and lamination are identified as relevant processes, together with electricity and thermal energy consumption.

Manufacturing generally contributes less than material production, but its relevance depends on the manufacturing processes. Electrical and thermal energy, machining, drying, pressing, coating and finishing can become significant contributors. Coating, finishing and adhesive-related processes can also be relevant because of associated emissions of VOCs and formaldehyde, depending on the formulations and processes used. Distribution can also be relevant and is sensitive to the geographical origin of materials and components, final market distances, transport mode and the mass and volume of the product.

While cleaning and general maintenance during the use phase have a limited contribution, product lifetime plays an important role in the overall environmental performance of furniture. However, additional evidence is needed on actual use duration and on the environmental effects driven by repair, component replacement, refurbishment and remanufacturing.

The relevance of end-of-life treatment varies across the studies and the products, depending on material composition, impact category and treatment route considered. Recycling, incineration with or without energy recovery, reuse and landfill can lead to substantially different environmental results, which are also influenced by methodological assumptions on substitution and biogenic carbon. Representative end-of-life scenarios therefore need to be defined for the base cases, with alternative scenarios considered where relevant to reflect this variability.

As far as the availability of inventory data is concerned, the analysis of the EPDs allowed to develop preliminary product clusters and average bill of materials (BoM). Product function was used as the main level of classification, in alignment with ongoing work within CEN/TC 270, according to which the following groups are identified: storage, seating, beds, tables and diverse. Material composition was also considered as complementary classification where relevant. For storage furniture and tables,

wood-based, metal-based and mixed-material configurations can be differentiated. For seatings, the complexity of material composition supports a function-based classification, including distinction between upholstered and non-upholstered products, and between different seating functions. For beds, no significant data points have been identified in literature. In total, 20 preliminary average BoMs were developed for storage, seating and table configurations, describing the following reference products: i) group “seats”: non-upholstered chairs; upholstered sofas; upholstered multipurpose office chairs; upholstered task chairs; upholstered visitor and lounge chairs; ii) group “storages”: wood-based small/drawers; metal-based small/drawers; wood-based low closed; metal-based low closed; wood-based tall closed; metal-based tall closed; metal-based open; iii) group “tables”: wood-based desk; metal-based desk; mixed materials desk; woos-based dining table; metal-based dining table; wood-based coffee table; wood-based meeting table.

Beyond the development of BoMs, a number of cross-cutting data needs remain for the modelling of the base cases. These include validation of representative product masses and BoMs; data on electricity and thermal energy consumption for manufacturing processes; production scraps and waste treatment; packaging; chemical inputs and emissions; assumptions on supply-chain and distribution; and end-of-life scenarios. The modelling of the base cases will also be supported by secondary LCI datasets. Sources identified at this stage include the EF 3.1 database for core processes, relevant datasets being developed in the framework of the PEFCR on Hotel Accommodation, and the Italian National LCA Database.

The existing information provides a useful starting point, but further evidence is needed to define representative EU values and scenarios. In this regard, stakeholder input will be important to contribute to assessing whether the preliminary product types and material configurations reflect current EU market practice, identifying configurations that may be missing or overrepresented, and providing additional evidence on manufacturing processes, logistics and end-of-life scenarios.

2. Introduction

The preliminary mapping of available LCA data represents the first sub-task (subtask 2.1) of Phase I of the preparatory study on furniture. This data will support the LCA modelling be carried out in Task 5 of the Methodology for Ecodesign of Energy-related Products (MEErP) during Phase II of the Preparatory Study. The activity correspond to the optional Task 0 – Quick scan of the JRC methodology (Torres et al. 2025), which is intended for broad or heterogeneous product groups and provides an early assessment of environmental impacts, improvement potential and data availability, as input for the analysis in Tasks 1-7, as illustrated in **Figure 2-1.**

This report forms part of the preparatory study supporting the future delegated act on furniture under the Ecodesign for Sustainable Products Regulation (ESPR). Its purpose is to describe the activities undertaken to investigate the environmental performance of furniture, map and screen currently available LCA information and data, and support the definition of the appropriate level of granularity for the product group. The results are intended to inform the scope definition and the data collection process in Tasks 2-4, anticipate methodological issues and data gaps before the assessment in Task 5,

and identify environmental aspects and modelling choices that require particular attention. Consequently, this preliminary screening aims at the early identification of relevant impacts and gaps in Task 0 of the MEErP to facilitate the correct environmental evaluation of the products at later stages of the preparatory study.

As part of this activity, a screening of existing studies regarding the LCA on furniture has been conducted, following the source hierarchy defined in Torres et al. (2025), which prioritises existing LCA studies in (also shadow) Product Environmental Footprint Category Rules (PEFCR), Product Environmental Footprint (PEF) studies as well as scientific literature and industry reports. No PEFCR on furniture have been developed yet, nor PEF-compliant studies were identified for this preliminary mapping. Therefore the review combined scientific literature in international journals with other relevant information from EPDs, LCI datasets and public research or projects. The analysis also builds on the criteria for literature screening developed by Cordella and Hidalgo (2016), and recalled in Torres et al. (2025).

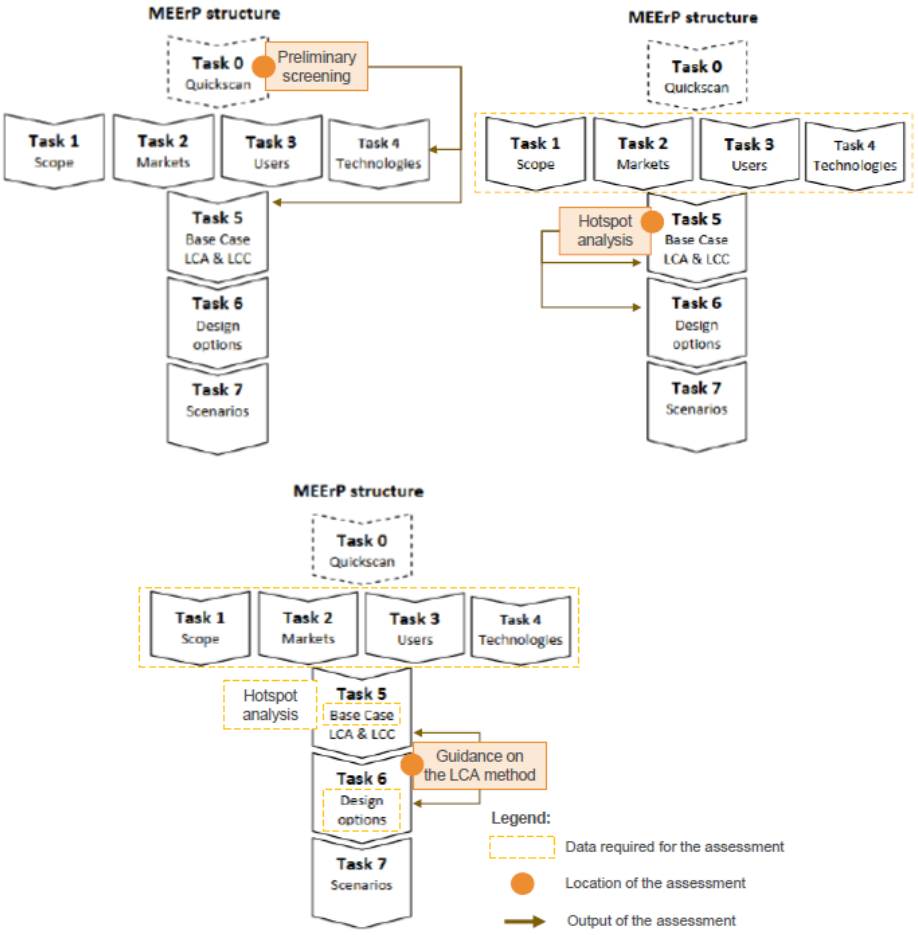

Figure 2-1: Interaction between Task 0 and the other Tasks of the preparatory study

Source: Torres et al., 2025

The report is structured as follows. Section 3 defines the goal and scope of the preliminary mapping, while Section 4 describes the search, screening and data classification methodology. Section 5 presents the results from the scientific literature

and EPDs analysis, including product coverage, environmental hotspots and the availability of data for LCA modelling. Section 6 summarises the main knowledge and data gaps, while Section 7 draws conclusions and provides recommendations for the subsequent definition and modelling of base cases. The annexes provide additional information on available LCI inventories, on the categorisation of the literature reviewed and on available LCi databases.

3. Goal and scope of the report

This report summarises the findings of the literature review that has been conducted on existing LCA studies on furniture. The screening has a threefold objectives: i) to identify environmental hotspots of furniture products, including components and processes; ii) assess the availability and usability of quantitative inventory data that could support the modelling of representative furniture base cases in Task 5; iii) to identify knowledge gaps and additional data collection needs, and discuss the measures to mitigate the gaps.

Furniture is a heterogeneous group of products that provides functions such as sitting, working, storage and sleeping and may contain solid wood and wood-based panels, metals, plastics, glass, textiles, foams, adhesives, coatings and other chemical formulations. Product systems also differ in expected service life, manufacturing technologies, maintenance requirements and end-of-life management. A comprehensive review of the LCA literature was carried out by Cordella and Hidalgo (2016) to inform the definition of the EU Ecolabel criteria (EU 2016/1632). The authors developed a qualitative-quantitative screening framework to derive robust preliminary indications on environmental hotspots and improvement options. This framework is also highlighted in Torres et al. (2025) as method to support the literature review, while not being enforced.

Their approach has been taken as methodological reference for the analysis of the literature and tested. However, it has been applied only to the scientific literature published in international journals, and flexibility has been considered in the interpretation of the criteria: results reported in articles scoring below the threshold were retained if equivalent findings were also reported by studies that achieved quality scores above the threshold.

4. Methodology

The JRC methodology for conducting the Task 0 Quick scan (Torres et al., 2025) defines a hierarchy for screening background information:

- results of hotspot analyses in Product Environmental Footprint Category Rules (PEFCR);
- results of Environmental Footprint (EF) studies, where available;
- results of independently peer-reviewed LCA studies in scientific literature; and
- public industry reports or other public technical sources.

However, given the lack of PEFCRs and of EF studies on furniture, the literature review was organised around four levels: scientific publications; Environmental Product Declarations (EPDs) from different programme operators; LCI datasets; and selected EU public research initiatives, such as projects funded under Horizon Europe or previous funding programmes.

Scientific literature

The literature search was conducted in Scopus using combinations of “life cycle assessment” or “LCA” with “furniture”, supplemented by searches for specific furniture products and relevant materials and processes. Product-specific terms included chair, seating, sofa, upholstered furniture, desk, table, wardrobe, cabinet, storage, bed, kitchen furniture and wood-based panels such as solid wood, soft wood, medium-density fibreboard (MDF) and medium-density particleboard (MDP). The search prioritised literature published after Cordella and Hidalgo (2016), because earlier furniture LCA evidence had already been screened in that study, while including a limited number of earlier studies when they provide inventories or evidence that remains relevant and that it is not replace by more recent studies.

Overall 28 publications have been identified in scope for the purpose of the quick scan. The relevance assessment follows the approach of Cordella and Hidalgo (2016). The evaluation is carried out at two levels: first, a verification of the fulfilment of inclusion criteria is conducted, checking coherence of the scope and alignment with ISO 14040/44, inclusion of at least one reference impact category using an impact assessment method of adequate scientific quality, and provision of findings relevant to the identification of environmental hotspots or improvement options. Only studies satisfying these inclusion criteria are considered for the qualitative-quantitative assessment. The second level consists of evaluating the studies against six criteria, namely: scope of the study, data quality and representativeness, impact assessment metric, relevance of findings, robustness of the study, presence of an independent review process. The criteria are evaluated according to a nominal 1-5 scale; data quality is evaluated by life-cycle stage and averaged across them. Studies with a total score of at least 15 out of 30 were selected for further analysis.

As anticipated in section 3, flexibility has been considered in the interpretation of the criteria: results reported in articles scoring below the threshold were retained if equivalent findings were also reported by studies that achieved quality scores above the threshold.

Overall, 22 studies exceeded the 15-point threshold, and obtained a total score ranging from 18.5 to 26.

EPDs analysis

The literature review showed that LCA studies focused on the furniture sector are limited and that several publications rely directly on data derived from EPDs. For this reason, a critical analysis of the available EPDs was carried out in parallel with the literature review, to obtain a larger number of data on product mass, bill of materials and declared environmental information. This data has then been structured to inform the further selection of base cases in Task 4 and provide also preliminary inventories for their modelling, to be conducted in Task 5.

EPDs were collected using a strategy combining automated retrieval and manual verification. The search targeted different furniture product categories and the databases and website of several EPDs programme operators, with the highest number of EPDs found in particular within EPD Global and the International EPD System®. The results were manually checked and complemented where necessary,

including only EPDs that were valid at the time of the search. Given the standard validity period of five years, the result consists mainly of declarations published from 2021 onwards.

The search was initially organized around the furniture functional categories classified according to CN-Code 9401 & 9403, namely storage furniture, seating furniture, beds, tables, and diverse products. Within the latter category, office partitions were the only products identified. The search resulted into a large number of EPDs for seating, tables, and storage products, whereas a limited number of documents were found for beds and miscellaneous products.

LCI databases and public research initiatives

Regarding LCI data and databases, the mapping included the core EF3.1 database, the forthcoming datasets developed in the framework of the ongoing PEFCR for Hotel Accomodation[1], and country-specific databases, such as the Italian National Database on LCA. All these sources were considered relevant for the purpose of the preparatory study, and the final list of datasets developed within the Hotel Accomodation PEFCR is expected to be made available by the end of 2026.

The detailed list of the datasets available in the Italian national database are listed in Annex 9.3.

As far as the public research initiatives are concerned, a search was conducted on the cordis website, delivering a total of 6 projects related to “furniture”. Out of these 6, only 1 project (SusBind[2]) has conducted LCA studies on bio-based adhesive systems as an alternative to adhesive systems based on a formaldehyde resin used for wood-based panel boards in furniture. Th results of these studies have been considered in the analysis of the literature outcomes in Section 5.

Other projects have foreseen to conduct LCAs, namely R-evolve[3] and FRANCESCA[4] but given that their conclusion is expected in 2028, results are not available yet.

[1] https://pefhotelaccommodation.eu/
[2] https://susbind.eu/
[3] https://r-evolve.eu/
[4] https://francesca.eco/

5. Results of the literature analysis

5.1. Scientific literature

5.1.1. Product coverage, materials and value-chain representation

The available literature focuses on indoor wood-based furniture, with the most represented finished products represented by seating, desk and tables and storage furniture. Beds are weakly covered, with only one study identified on bunk bed, while for outdoor furniture, children's furniture and multifunctional furniture no literature has been identified fulfilling the quality requirements for their screening.

A second cluster of studies addressed MDF, melamine-coated MDF, MDP, recycled composite boards and end-of-life MDF as material or semi-finished products.

An overview of the main product families, specific furniture products and materials covered are described in **Table 5-1**.

Table 5-1: Main furniture products and materials covered in the analysed literature, including both structural and other materials.

Product family	Product/process represented	Materials	Source
Seating (non-upholstered)	Office and conference chairs; wooden armchair; stools	Solid wood and plywood; steel and aluminium; propylene; textiles; PU cushion; adhesives and coatings	Askham et al. (2012) Bianco et al. (2021) Linkosalmi et al. (2016) Yang et al. (2025a) Yang et al. (2025b)
Sofas/upholstered seatings	Three-seat sofa with and without melamine flame retardant; leather sofa; additional sofa cases.	Wood and plywood frame, PU foam, leather or synthetic leather; textiles; steel springs; ABS, adhesive.	Aggarwal et al. (2026) Wan et al. (2025) Yang et al. (2025b)
Desks and tables	School desk; pinewood and oak tables; wood and laminate office desks.	Solid wood, MDF, plywood, wood veneer, steel and aluminium, glues and resins, coatings, varnishes, plastics.	Lestari and Pulansari (2025) Linkosalmi et al. (2016) Mirabella et al. (2014) Pulansari et al. (2026) Sakib et al. (2024) Tessitore et al. (2025) Yang et al. (2025b)
Storage furniture	Double-door wardrobe; office cabinet; kitchen cabinet.	MDP, MDF and other wood-based panels; solid wood, metals, plastics, adhesive, coatings.	Iritani et al. (2015) Li et al. (2019) Linkosalmi et al. (2016) Medeiros et al. (2017) Yan et al. (2025b)

Product family	Product/process represented	Materials	Source
Bed	Bunk bed	Softwood, plywood, steel, polyurethane adhesive, varnish	Coloma-Jiménez et al. (2022)
Furniture materials/components	MDF; melamine-coated MDF; recycled composite boards	Wood fibres and chips, thermosetting resins, paraffin, decorative paper; recycled and virgin polymers.	Piekarski et al. (2017) Yilmaz (2024) Costa et al. (2026)
End of life material process	Pyrolysis vs incineration of MDF	End of life MDF with lignocellulose and urea-formaldehyde resin	Wang et a. (2026)

Across these products, wood is the most common structural material, either as solid wood or as engineered panels. Solid wood is used in chairs, armchairs, tables, desks and the bunk bed, while engineered wood products such as plywood, MDP, MDF, high-density fibreboard (HDF) and veneer occur across seating, sofas, desks, wardrobes and cabinets. Metals, mainly steel and aluminium, are represented both as primary structural systems in some office seating and desks and as frames, legs, springs, fasteners, mechanisms and fittings in wood-based products.

The other materials covered in the studies can be grouped into upholstery and padding materials, hardware and connectors, adhesives and resins, surface treatments and finishes, decorative layers, plastics and specific chemical additives. Upholstered chairs and sofas include polyurethane foam, leather or synthetic leather and textiles, together with springs, screws and plastic components. Storage furniture and office furniture include fittings, levelling feet and other small plastic or metal components.

Regarding packaging, paper-based packaging, which includes corrugated cardboard, paperboard or folding boxboard, is the most common type. Plastic film is included in some cabinet, and protective polymer foam is reported for tables distribution.

Compared to Cordella and Hidalgo (2016), the updated literature confirms the same broad material range, with an increased focus on engineered wood panels. However, a comparison between the materials represented in the scientific literature and those observed in the more recent EPDs indicates that the literature does not fully reflect the material diversity of furniture currently placed on the market. EPDs shows that plastics can represent a substantial fraction of the product mass, particularly for office and contract seating, and also identifies composites, glass, minerals and electrical and electronic components in current products. Bamboo, rattan and cork are also not represented in the analysed literature.

Manufacturing processes are represented with different levels of detail. For solid-wood and panel furniture, main processes accounted for include kiln drying, sawing or cutting, CNC or other machining, drilling, sanding, gluing, coating or painting, assembly and packaging.

For panels, specific processes include chipping and fibre preparation, resin dosing, drying, forming, hot pressing, sanding and lamination. Upholstered furniture includes

frame processing, foam cutting and gluing, sewing upholstery operations and final assembly. Machining of steel or aluminium components are also included.

5.1.2. Environmental hotspots

The results of the analysis of the environmental hotspots conducted by Cordella and Hidalgo (2016) is confirmed by the updated literature. According to Cordella and Hidalgo (2016), production and supply of materials contribute between 88–98% to the environmental profile of furniture products, depending on the impact category, while manufacturing contributes between 2–12% and distribution 6–14%. The use stage was negligible, while end-of-life can contribute up to 22%, depending on the specific products, and treatment scenarios.

Regarding material production and supply, Linkosalmi et al. (2016), covering eight Finnish furniture cases ranging from chairs to cabinets, report that materials account for 38–90% of climate change impact category, compared with 8–58% for processing and assembly and 1–8% for packaging and logistics. For the sofa assessed by Wan et al. (2025), raw material acquisition represents about 77.4% of the total single score, with plywood, leather and metal fittings among the relevant contributors. In the wooden armchair case of Bianco et al. (2021), the raw-material phase accounts for about 86% of climate change impact category, driven mainly by plywood and polyurethane cushioning. The broader 25-product comparison by Yang, Vezzoli and Su (2025) similarly identifies material supply as the dominant stage on average, with a magnitude that according ot the product categories analysed.

For wood-based panels, burdens are generated not only from wood supply but also from the energy and chemical inputs required to manufacture the panel. Piekarski et al. (2017) identify natural gas used for thermal energy, urea formaldehyde resin, electricity, wood chips and raw material transport as key drivers for environmental impacts of MDF, with drying and continuous pressing important for photochemical ozone formation and formaldehyde emissions from pressing as main contributor to human toxicity. Yılmaz (2024) reaches a similar conclusion for melamine-coated MDF, with fibre preparation representing the main hotspot, followed by lamination. Moreover, urea-formaldehyde resin, used as synthetic adhesive, is the main environmental hotspot. These findings are consistent with Cordella and Hidalgo (2016) according to whom panel performance is highly sensitive to resin systems, energy sources and the efficiency of drying and pressing.

Li et al. (2019) finds that raw material supply and energy consumption dominate the wardrobe environmental profile and shows that changing the panel binder and increasing wood waste use can reduce impacts. This finding was confirmed also by Costa et al. (2025), according to whom waste-based boards present lower environmental impacts compared to formulations incorporating virgin polymers.

Regarding the manufacturing stage, the main contributors are electrical and thermal energy consumption, as highlighted also by Cordella and Hidalgo (2016). Piekarski et al. (2017) identify drying and pressing as important contributor to the MDF processes; Yılmaz (2024) highlights fibre preparation, forming, finishing and lamination, with electricity and thermal energy concentrated in fibre preparation and lamination. The relevance of finished processes is also confirmed in the analysed literature, with main

improvement levers represented by higher energy efficiency, recovery of production waste and substitution of high-emission coatings where technically feasible.

The relevance of the inbound and outbound transportation varies depending on the origin of materials and components, the location of manufacturing sites and final markets, and the mass and volume of the products. Coloma-Jiménez et al. (2022) report that the downstream stage of bunk bed contributes around 58% to climate change impact, and final customer transport represents around 82% of that downstream contribution. The same study shows large changes when the sales distance or origin of wood is varied. Medeiros et al. (2017) similarly find that transport of inputs accounts for 40% of climate change impact of office cabinet. Bianco et al. (2021) attributes 13% of armchair global warming potential (GWP) to the long-distance supply of plywood from Russia to Italy. When materials mainly come from the same country in which the manufacturing processes are located, like in the Finnish case studies (Linkosalmi et al., 2016), the relevance of transportation decreases significantly.

The relevance of the use phase is low in the studies in which it has been accounted for, confirming the insights from Cordella and Hidalgo (2016). Yang et al. (2025) consider small quantities of water for wiping and electricity for vacuum cleaning where relevant, while Aggarwal et al. (2026) assumes no cleaning, material or energy input during the use of the sofa, but includes melamine flame-retardant emissions to air and water. Coloma-Jiménez et al. (2022) has considered the replacement of selected parts of the bunk bed, two front bars and two steps of the staircase, and the application of a varnish coating, whose influence on the final results was negligible. For durable products such as furniture, the actual period of use defines how frequently the impacts associated with material production, manufacturing, distribution and end-of-life are incurred in relation to the service delivered. Thus, product lifetime can be a key parameter in the environmental performance of furniture. However, the analysed studies do not sufficiently address strategies for extending the service life of furniture, and rely on assumed service lives and provide little evidence on actual furniture durability, replacement behaviour or the effectiveness of strategies for extending lifetime. An exception is represented by Russel et al. (2023) that shows that reuse, repair and refurbishment can reduce new-material requirements when furniture is sufficiently durable and designed to enable additional service cycles.

Regarding the EoL stage, the literature confirms that its relevance depends on the treatment scenario and can vary substantially across impact categories. Cordella and Hidalgo (2016) report average EoL contributions ranging from −1% to 22% (relative to cradle-to-gate impacts), while also showing wider variation among individual cases. The authors identify the disposal scenario as the main factor explaining this variability, with environmental credits occurring when material recycling and energy recovery substitute other products or energy carriers. Medeiros et al. (2017) similarly show that the EoL stage of an office cabinet can represent more than 5% of the total impact in several categories, and up to 18% for global warming and 53% for freshwater ecotoxicity. The same study shows that reuse, recycling and energy recovery can generate significant environmental gains, although their magnitude depends on the substitution, the assumptions on the waste management and on biogenic carbon accounting. The EoL is also affected by material composition and by the substances contained in furniture components. For EoL MDF, Wang et al. (2026) highlights that

conventional treatments can generate emissions associated with the decomposition of urea-formaldehyde adhesives. According to the authors, compared with incineration, pyrolysis can reduce GHG emissions by 62–81% and substantially mitigate adhesive-related pollution. For wood waste from furniture production, Pinho et al. (2025) identifies recycling scenarios as promising compared with energy recovery and supports cascading material use before final energy recovery.

Finally, chemical-related impacts are only partially addressed in the analysed literature. Piekarski et al. (2017) identify urea-formaldehyde resin as a major MDF input and quantify formaldehyde emissions during the pressing process of MDF as main contributors to toxicity-related impact categories.

Yılmaz (2024) finds that urea-formaldehyde resin is the main contributor across several impact categories of the laminated MDF. Aggarwal et al. (2026) has compared sofas with and without melamine flame retardants based on LCA, developing new carcinogenic and non-carcinogenic human toxicity characterization factors for melamine using the USEtox 2.14 methodology. The results show that the contribution of the melamine flame retardant to the overall impact is small, mainly due to the low quantity used and the relatively low toxicity of melamine. However, results might change when applied to other products involving hazardous flame retardants with higher concentrations and toxicities, for which the health impacts could be considerable.

Overall, coatings, solvents, adhesives, flame retardants and other additives are present in many inventories but are not described with sufficient formulation or details on emissions, which represent and remains an important gap.

5.1.3. Reproducible inventories from the analysed literature

The availability of inventories for modelling furniture products was also investigated, as input for the base case modelling. Among the analysed publications, only a limited number of complete product and process inventories were identified, more specifically for the following furniture products:

- Sofa (Aggarwal et al. 2026; Wan et al. 2025)
- Bunk bed (Coloma-Jiménez et al. (2022)
- Wardrobe (Li et al. (2019)
- Office cabinet (Medeiros et al. 2017)
- MDF, MDF laminated and EoL of MDF (Piekarsli et al. 2017; Yilmaz 2024; Wang et al. 2026)
- Recycled composite boards (Costa et al. 2026)

While these inventories cannot be considered representative neither from a market nor from a geographical point of view, they represent additional data points that – together with the analysis of the EPDs described in Section 5.2 – can provide a first reference for informing the BoM of the base cases, to be further validated by and integrated with stakeholders inputs.

5.2. EPDs analysis

The collected EPDs were analysed and elaborated with the ultimate goal of building up first BoM that – together with the LCI inventories identified in Section 5.1.3 – can inform the identification of the base cases. EPDs for which the required information was insufficient or difficult to interpret were excluded. For tables, an additional criterion related to the functional or declared unit was applied: more specifically, EPDs using units not directly attributable to an individual product were excluded from the analysis. This included, for example, declarations referring to square metres of office space rather than to a single item.

Overall, 203 EPDs have been analysed and structured into a database, which include 55 storage EPDs, 71 table EPDs and 77 seating EPDs. Beds were not sufficiently represented, with only 3 EPDs identified, as well as the functional category “diverse”: both were thus excluded from the analysis. The database was implemented in Microsoft Excel using Power Pivot and Data Model environment to allow for cross-filtering, analyses by category and cluster.

To enable the comparison across different products covered by EPDs, belonging to the same functional group, the information contained in the BoMs was harmonised according to a common taxonomy. The materials reported in the EPDs were aggregated into 13 broad material categories:

- Adhesives, coatings and finishes
- Composites
- Electrical and electronic components
- Glass
- Ferrous metals
- Non-ferrous metals
- Minerals
- Other materials and components
- Other metallic materials and components
- Paper and printed paper
- Plastics
- Textiles and upholstery materials
- Wood-based materials

The level of aggregation was kept broad to facilitate the comparison of BoMs from EPDs that differ in terms of detail and material nomenclature.

For each product, the following parameters were defined: total mass, mass of each material category, and the mass share of each category expressed as a percentage of the overall product mass. Where necessary, product weight was normalized according to the function performed by the product. For seating and table products, this involved normalizing mass by the number of users served. For example, a sofa designed for three users was converted to a per-seat basis, while a table designed for four users was converted to a per-user basis.

Thus, the elaborated data allow the analysis of both normalized absolute masses of the different material categories and their relative composition, expressed as percentage mass shares.

The objective of the preliminary clustering is to identify groups of products that are sufficiently homogeneous and representative to support the selection of base cases, by combining product functionality, characteristics of the BoM and material mass composition. The initial level of classification is thus based on product function. Within the functional categories storage furniture, seating furniture and tables, subcategories were identified to distinguish products with different functions and characteristics, such as desks versus dining tables or chairs versus stools. Material composition was used to refine these groupings, where necessary.

As a preliminary quality check of the classification, an analysis of both intra-group and inter-group variability was carried out on a sample basis, considering the mass percentages of the different material categories. The aim was to assess whether composition variability within a cluster was generally lower than the variability observed between different clusters. This check was carried out on a sample basis and not across the full database. In addition, no statistical optimization methods were used to define the clusters. Thus, the current classification should be considered preliminary and may be refined as further data and feedback become available.

Storage

For storage products, a two-level classification system was defined. The first level is based on functional and dimensional criteria, reflecting the high heterogeneity within this product category. Five groups were identified:

- Small storage and drawer units, including products such as bedside tables and small storage units;
- Low closed storage, including low-height storage units with enclosed compartments;
- Tall closed storage, including taller enclosed units such as wardrobes and some kitchen storage elements;
- Open storage, including systems without front closures, such as bookcases and shelving units;
- Specialised storage, a residual category for products with specific functions that are not sufficiently represented by the previous groups.

At a second level, each group are further classified according to the main material in its BoM. Products are classified as:

- Wood-based, when the combined mass of all wood-based materials is more than 50% of the total product mass;
- Metal-based, when ferrous and non-ferrous metals together account for more than 50% of the total mass;
- Other/mixed materials, when no material group accounts for more than 50% share of the total mass.

Tables

The same approach was applied for tables. Four main product types were identified: desks, dining tables, small/coffee tables, and meeting tables. The distinction between some categories is not always straightforward when based only on shape or dimensions; in particular desks and dining tables may be very similar in terms of geometry. In those cases, the classification was based not only on physical characteristics but also on the intended function of the product. For example, desks may include features specifically designed for office use, such as cable management systems, dividers, footrests, and other accessories that usually are not included in dining tables.

The preliminary analysis of the BoMs also highlighted differences in material composition between categories. For example, desks usually show a higher proportion of plastic materials compared with other table types.

As for storage products, a second- level classification is applied to tables based on the main material. Using the same 50% threshold, products are classified as wood-based, metal-based, or other/mixed-material.

Seatings

For seating products, material composition did not provide a clear basis for classification as it did for tables and storage products. Many seating products are made from a combination of different materials, with neither wood nor metal consistently accounting for a dominant share of the total mass.

A function-drive classification was therefore applied for seating products. At the first level, products were divided into upholstered or semi-upholstered seating and non-upholstered seating. Within the non-upholstered category, the main product types identified were chairs, stools, and benches. However, the number of stools and benches available in the dataset is too limited to support a robust characterization of these categories as separate clusters. Non-upholstered chairs, on the other hand, are relatively homogeneous, even if their material composition varies and no single material category stands out. Based on the number of data points and on the variability observed, no further subdivision could be justified. For upholstered seating, the main product types identified were sofas, benches, and chairs. For multi-seat sofas and benches, product mass was normalized according to the number of users served.

The larger number of upholstered chairs allowed a more detailed classification. In particular, a distinction was made between fixed seating, intended for applications such as conference, visitor, or lounge settings, and task chairs, which typically include features that allow users to move, adapt the chair to the individual needs and are commonly used in office environments.

Overall, following the clustering and data elaboration approach described above, 20 average BoMs have been defined, illustrated in **Table 5-2**, **Table 5-3** and **Table 5-4** as basis for discussing the definition of the base cases.

5.3. Public research initiatives

Among the identified research and innovation initiatives on furniture, only one project was identified that has conducted LCA studies, namely the SusBind project[5] (Development and pilot production of sustainable bio-binder systems for wood-based panels; Grant Agreement 792063, 2018-2022). SusBind developed and tested a partly bio-based, formaldehyde-free adhesive for particleboard and medium-density fibreboard, reaching TRL 5. The LCA was conducted to compare alternative feedstocks and formulations and to identify options for reducing the environmental impacts of the developed bio-based adhesive system (CE Delft, 2018, 2022).

The available documentation reports non-confidential inventories for precursor and resin production and for particleboard and MDF board manufacture, including resin and additive contents, wood input, electricity and heat, and end-of-life assumptions. The inventories are expressed per 1 m3 of particleboard or MDF and distinguish different adhesive contents (CE Delft, 2022). Considering that the data used for the study include pilot-scale assumption for the innovative system, their use in the preparatory study will be limited to scenario analysis when analysing different improvement options.

[5] https://susbind.eu/

Table 5-2: Subcategories and average BoMs for the functional group "seatings".

Material category	Non-upholstered chairs	Upholstered Sofas	Upholstered Multipourpose Office Chairs	Upholstered Task Chairs	Upholstered Visitor and Lounge Chairs
	Share [w/w%]				
Adhesives, coatings and finishes	0,04%	2,07%	4,27%	0,18%	-
Composites	-	-	0,36%	0,23%	-
Electric and electronic components	-	-	-	-	-
Glass	-	-	-	-	-
Metals – Ferrous	40,53%	9,81%	30,04%	31,38%	40,10%
Metals – Non-ferrous	6,13%	2,15%	9,23%	17,76%	10,57%
Minerals	-	-	-	-	-
Other materials and components	4,58%	0,20%	0,58%	2,06%	0,15%
Other materials and components (Metal)	-	-	-	-	-
Paper and printed paper	-	0,05%	-	-	-
Plastics	39,72%	8,54%	17,45%	40,59%	30,89%
Textiles and upholstery materials	4,37%	17,19%	11,75%	5,70%	17,67%
Wood based materials	4,63%	59,99%	26,30%	2,09%	0,62%
Average weight [kg]	**11,35**	**49,73**	**13,97**	**17,93**	**12,06**
Refernce Service Life (RSL) declared	10-15 years				

Table 5-3: Subcategories and average BoMs for the functional group "storage".

Material category	Wood-based Small/Drawers	Metal-based Small/Drawers	Wood-based Low closed	Metal-based Low closed	Wood-based Tall closed	Metal-based Tall closed	Metal-based Open
			Share [%]				
Adhesives, coatings and finishes	0,21%	5,89%	0,17%	-	0,37%	3,36%	0,39%
Composites	-	-	-	-	-	-	-
Electric and electronic components	-	-	-	-	-	-	-
Glass	-	-	-	-	-	-	-
Metals – Ferrous	15,42%	88,63%	4,95%	99,99%	1,99%	85,40%	3,16%
Metals – Non-ferrous	-	0,71%	-	-	-	0,96%	-
Minerals	-	-	-	-	-	-	-
Other materials and components	-	0,22%	0,14%	-	-	-	-
Other materials and components (Metal)	9,12%	-	3,24%	-	3,04%	-	5,85%
Paper and printed paper	-	-	-	-	-	0,01%	-
Plastics	5,54%	4,50%	8,61%	0,01%	7,31%	2,75%	7,63%

Textiles and upholstery materials	0,00%	-	-	-	-	-	-
Wood based materials	69,71%	0,05%	82,88%	-	87,30%	7,51%	82,96%
Average weight [kg]	**30,77**	**10,27**	**51,21**	**22,23**	**55,76**	**37,49**	**30,24**
Refernce Service Life (RSL) declared	15 years						

Table 5-4: Subcategories and average BoMs for the functional group "tables".

Material category	Wood-based Desk	Metal-based Desk	Mixed material Desk	Wood-based Dining table	Metal-based Dining table	Wood-based Coffe table	Wood-based Meeting table
	Share [%]						
Adhesives, coatings and finishes	0,52%	0,47%	1,27%	1,37%	0,66%	2,36%	0,89%
Composites	0,17%	-	-	0,38%	-	3,24%	-
Electric and electronic components	-	-	2,06%	-	-	-	-
Glass	-	-	-	-	55,86%	-	-
Metals – Ferrous	33,40%	23,86%	37,11%	10,01%	1,83%	12,67%	18,57%

Metals – Non-ferrous	2,36%	0,25%	0,36%	0,03%	0,34%	7,56%	7,69%
Minerals	-	-	-	-	1,07%	-	-
Other materials and components	-	27,78%	20,95%	4,71%	-	1,28%	0,78%
Other materials and components (Metal)	-	29,88%	-	1,90%	40,23%	-	-
Paper and printed paper	-	-	-	-	-	-	-
Plastics	1,11%	0,66%	1,67%	0,85%	-	0,54%	1,65%
Textiles and upholstery materials	-	0,38%	1,38%	-	-	0,00%	0,39%
Wood based materials	62,44%	16,73%	35,20%	80,75%	0,66%	72,36%	70,02%
Average weight [kg]	**27,93**	**46,82**	**58,23**	**47,47**	**34,97**	**15,42**	**111,76**
Refernce Service Life (RSL) declared	15 years						

6. Data gaps

The analysis of the literature and data highlights significant differences in the availability of information across furniture categories and across the parameters needed for the modelling of the base cases.

6.1. Data gaps by furniture product category

The strongest evidence currently available relates to office and corporate seating, tables and desks, and storage furniture. For these categories, a relatively large number of products could be characterised in terms of both mass and material composition, providing a reasonable basis for the development of representative product groups. However, also for these categories important gaps remain. While the available data are generally sufficient to describe product composition, which however require to be validated also with the expert input of stakeholder, they do not include the full list of inputs needed for their modelling, in particular the following information and data are missing: manufacturing processes and related consumption data, finishing processes, chemicals, ancillary materials, distribution and end of life scenarios.

Several categories remain only partially covered by the available evidence. This is particularly the case for beds, outdoor furniture, some seating types, kitchen and bathroom furniture, children's furniture and multifunctional products.

Outdoor furniture stands out as one of the most significant gaps. This applies both to outdoor seating and tables intended for residential use and to products that are closer to urban or public-space furniture. Because these products can be based on very different construction systems, ranging from wood and metals to plastics and mineral materials, the currently available evidence is not sufficient to define representative product types. Additional information is therefore needed not only on product mass and material composition but also on the relative importance on the market.

For seating, corporate and office chairs are sufficiently represented, covering both upholstered and non-upholstered configurations. By contrast, stools, bar stools, benches, armchairs, some domestic seating types and part of the variability seen in sofas is not sufficiently represented.

In this case, the main need is to understand whether these product types differ enough from the existing seating clusters to justify dedicated base cases. Understanding this requires the availability of additional information on product mass, material composition and construction characteristics. Durability and service-life information are also key parameters to further investigate, given the different operating conditions for office, domestic and contract furniture.

Beds remain one of the least documented furniture categories. Since mattresses are outside the scope of the present assessment, the focus is limited to bed frames. Only a very small number of relevant datasets were identified, which did not allow to describe

a representative product configuration. Additional information is needed on typical product mass, material composition and structural design, as well as on manufacturing requirements, expected service life and end-of-life management practices.

The situation is different for **kitchen furniture**. The main issue is not the availability of information on complete kitchen configurations, but the extent to which the product types already identified and characterised in the analysis can be considered representative of furniture components typically used in kitchens. A number of common kitchen elements, such as cabinets, drawer units, shelving and table-like components, are comparable from the functional perspective to those already covered within the storage and table categories. Further assessment would be needed, supported by stakeholders input, to evaluate whether the identified product types can be considered representative of current market practice for use in kitchen, whether specific adjustments would be required, or whether additional kitchen-specific product configurations should be considered in the definition of the base cases.

Evidence is also limited for **children's furniture and multifunctional furniture**. At this stage, it is unclear whether these products can be represented using the same product types identified for the other furniture categories or whether they require dedicated base cases. Addressing this question will require understanding the design features that distinguish these products from more conventional furniture types.

6.2. Cross-cutting data gaps for modelling base cases

Beyond the gaps identified for specific furniture categories, the preliminary mapping indicates a number of cross-cutting data needs that are relevant to the modelling of representative base cases. These are related to product composition, manufacturing, service life and durability, chemical inputs and emissions, logistics, and end-of-life management.

While the literature analysed provides a useful basis for identifying the parameters to be considered in the modelling, in several cases the available data refer to individual products, manufacturers, geographical contexts or technologies and cannot be considered representative of average conditions on the EU market. Further evidence will thus be needed during the next stages of the preparatory study to define representative values and scenarios.

- **Product composition and manufacturing data**
    - The input of stakeholders will be important to validate the identified product groups and their bills of materials, in particular for those characterised by a high degree of material diversity, including furniture containing different combinations of wood-based materials, metals, plastics, composites, glass, foams and textiles. Additional information to collect includes electricity and thermal energy consumption for the different manufacturing processes, scraps, waste generation and treatment, and packaging.

- **Service life and durability**
    - The analysed studies generally use a fixed reference service life based on technical assumptions or provisions given in the PCRs, while limited information is available on the actual time furniture remains in service under different market and use conditions.
    - Further information would then be needed to distinguish between technical or design lifetime and actual duration, reasons for product replacement, and the additional lifetime achieved through maintenance, repair, refurbishment, remanufacturing or reuse. Measures intended to extend the service life may require additional materials, more durable components, different surface treatments or additional manufacturing processes. These additional requirements should be considered in the modelling of base cases together with the potential benefits associated with avoiding or delaying the production of replacement products.
- **Chemicals, coatings and product-related emissions**
    - The analysis also pointed out a limited availability of information on chemical formulations, in particular composition and quantities of adhesives, resins, coatings, solvents, flame retardants and related emissions.
- **Supply chains and distribution**
    - The inbound and outbound transportation of materials and furniture products varies according to the geographical origin of materials and components, and destination market. Moreover, the transport is affected by the mass or volume of the transported product. Assumptions on packaging configuration and distribution will be defined for describing logistics scenarios of the base cases, informed also by the feedback provided during the stakeholder consultation.
- **End-of-life management**
    - Existing studies consider a range of treatment routes, including recycling, incineration, energy recovery and landfill, which reflect either country-specific situations or scenarios defined specifically for the studies. For the modelling of base cases, given the lack of EU dedicated furniture waste category in the official statistics, and considering that EoL depends also on the materials used and their share in the final product, scenarios need to be defined, building upon the current EoL pathways defined in the Preparatory Study.
    - The identified needs for data gaps and data validation will be addressed through additional data collection and retrieval from e.g., furniture manufacturers' catalogs, and stakeholder inputs. The latter, in particular, would be particularly valuable for validating the product types identified, their BoM and the scenarios for transportation and end of life.

7. Conclusions and recommendations for the base cases definition

The preliminary mapping provides an initial base for the definition and modelling of furniture base cases in Task 5. The work has addressed three main objectives: identifying the environmental hotspots associated with furniture products, components and processes; assessing the availability and potential usability of quantitative inventory data; and identifying the main knowledge gaps and additional data needs that should be addressed before the base cases are finalised.

The analysis confirms the findings of Cordella and Hidalgo (2016) in relation to the environmental hotspots. The production and supply of materials are the most relevant life cycle stages, although its relative importance varies according to the product configuration and the materials used. Wood and wood-based panels are widely represented, but resins, metals, plastics, polyurethane foams, leather, textiles and other materials can also make significant contributions. The impact of the manufacturing stage is mainly driven by electricity and thermal energy consumption for drying and pressing, machining. Moreover, coating and finishing processes may represent an important source of emissions. Depending on the formulations used, emissions associated with coatings and adhesives may include different groups of VOCs, such as alcohols, olefins, ethers, alkanes and aldehydes (Donatello et al., 2017; Yang, 2022). Formaldehyde is also relevant for wood-based panels and can be released during drying, gluing and painting stages (Mirabella et al., 2014).

Transport and distribution depend on the origin of materials and components, destination markets, transport modes and the mass and volume of the product. In some cases, long-distance sourcing or distribution can become also a major contributor. The analysis of end-of-life stage also highlights a significant variability in terms of environmental impacts. Existing studies consider different combinations of recycling, incineration, energy recovery and landfill, often reflecting country-specific conditions or scenario assumptions.

As far as the availability of quantitative data is concerned, the mapping identified a number of data points for products and processes that can support the preliminary definition and modelling of base cases. In this context, the analysis of EPDs provides relevant complementary information to the scientific LCA literature, in particular for characterising the material composition of furniture products. While the scientific literature covers a more limited range of product and material configurations, the EPDs broaden the evidence base and highlight, for example, the relevance of plastics in office and contract seating, as well as the occurrence of composites, glass, mineral materials and electrical and electronic components.

For tables and storage furniture, the combination of functional classification and material composition makes it possible to distinguish between wood-based, metal-based and mixed-material configurations. For seating, the increased complexity of material composition supports a function-based classification, including distinctions between upholstered and non-upholstered products and between different seating functions. Overall, 20 average BoMs have been defined, covering storages, seatings and tables.

The analysis also highlighted different data availability across furniture categories. The strongest evidence is currently available for office and corporate seating, tables and desks, and storage furniture. For these groups, the main next step is to validate the proposed product types and preliminary bills of materials and to assess whether the observed variability requires separate base cases or sensitivity analyses. Further evidence is needed for outdoor furniture, beds, stools and benches, armchairs, some domestic seating configurations, children's furniture and multifunctional furniture, as well as kitchens and bathroom furniture.

The modelling of the base cases will be supported by the availability of background datasets, describing both core processes and also furniture specific products, which will be considered not as a replacement of the specific products but rather as an additional data sources to validate the elaborated BoM. The dataset sources identified include EF 3.1 for core processes, relevant datasets developed in the context of the PEFCR on Hotel Accommodation, and the Italian National LCA Database.

Beyond product-specific gaps, a number of cross-cutting data needs remain relevant to all base cases. These concern manufacturing data on electricity and thermal energy, scraps and waste treatment, packaging, chemical inputs and emissions – in particular coatings, adhesives, resins, solvents, flame retardants - transport and distribution assumptions, service life and durability, and end-of-life scenarios. Among these aspects, service life and durability require particular attention. The available studies generally rely on fixed reference service lives, while evidence on actual time in service and reasons for replacement is limited. Further information would be useful on actual use duration and the extent to which maintenance, repair, component replacement, refurbishment, remanufacturing and reuse translate into additional years of service.

The identified gaps indicate where further evidence and validation is needed, and stakeholder consultation will be important in this process. Feedback would be particularly useful to validate the proposed product types and material configurations, identify relevant configurations that may be missing or overrepresented, confirm typical product masses and bills of materials, and provide further evidence on manufacturing processes, service life, logistics and end-of-life scenarios.

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9. Annexes

9.1. Annex I – Categorisation of the analysed literature

Table 9-1 Analysis of the literature.

Author(s)	Title	Furniture product/process covered	Geographical application	Main goal	System boundary	Functional/declared unit
Aggarwal, R.; Arvidsson, R.; Peters, G. (2026)	Are melamine flame retardants in sofas beneficial from a life cycle perspective?	Three-seat upholstered sofa; comparison with/without melamine flame retardant	Use and EoL: Sweden; material markets: global	Compare environmental impacts and net human-health implications of using melamine flame retardant in a sofa, combining LCA with quantitative health-risk assessment.	Cradle-to-grave: raw-material extraction, manufacturing, 10-year residential use, and end-of-life incineration. Distribution to final user and transport to EoL excluded. The use stage includes melamine emissions to air and water for the sofa.	Provision of sofa seating for one household over 10 years; reference flow = 1 three-seat sofa.

Author(s)	Title	Furniture product/process covered	Geographical application	Main goal	System boundary	Functional/declared unit
Bianco, I.; Thiébat, F.; Carbonaro, C.; Pagliolico, S.; Blengini, G.A.; Comino, E. (2021)	Life Cycle Assessment (LCA)-based tools for the eco-design of wooden furniture	Wooden armchair	Italy (Turin prototype/manufacturing context); birch plywood supply from St Petersburg, Russia; Italian/Russian market scenarios.	Develop LCA-based tools for experts and non-experts and test them on a wooden armchair to identify improvement scenarios.	Upstream, core and downstream stages according to furniture PCR, from raw materials to end of life. Distribution of the final product included.	Case-study functional unit = 1 armchair for 1 year of use (with 10-year expected lifespan used in the model).
Coloma-Jiménez, M.; Akizu-Gardoki, O.; Lizundia, E. (2022)	Beyond ecodesign, internationalized markets enhance the global warming potential in the wood furniture sector	Wooden bunk bed	Northern Spain; local and international market scenarios	Quantify cradle-to-grave impacts of an eco-designed bunk bed and evaluate how local vs international sourcing and sales affect performance.	Cradle-to-grave under the PCR “Furniture, except seats and mattresses”: upstream, core and downstream; capital goods, employee commuting/business travel and R&D excluded.Distribution of the final product included.	For cross-study comparison, 1 kg of fabricated furniture. The underlying product reference is one complete bunk bed including packaging over a 15-year lifespan.

Author(s)	Title	Furniture product/process covered	Geographical application	Main goal	System boundary	Functional/declared unit
Costa, I.; Machado, B.; Silva, B.; Dias, C.; Silva, L.; Carvalho, I.; Sá, V.; Pereira, A.; Basto-Silva, C. (2026)	From Waste to Resource: An Evaluation of Circular Economy Practices in Furniture Production	Particleboards made with different proportions of polyethylene recycling waste	Portugal (polyethylene recycling waste sourced from a Portuguese plastic recycling company)	Compare environmental and economic performance of waste-based vs virgin-polymer board formulations using integrated LCA and LCC.	Cradle to gate; administrative/lab functions and capital goods excluded.	1 kg of polyethylene recycling waste for waste treatment.
Iritani, D.R.; Silva, D.A.L.; Saavedra, Y.M.B.; Grael, P.F.F.; Ometto, A.R. (2015)	Sustainable strategies analysis through Life Cycle Assessment: a case study in a furniture industry	Medium-density-particleboard wardrobe	Brasil	Assess wardrobe environmental performance and test sustainable strategies, including logistics optimization and use of recycled wood in MDP[6].	Cradle-to-gate: raw-material supply, wardrobe manufacturing, and distribution of the finished wardrobe to the customer region. Distribution of the final product included.	40 kg of goods stored for 5 years; reference flow = 1 wardrobe unit.
Lestari, A.D.A.; Pulansari, F. (2025)	Environmental Impact Analysis on Furniture Industry by Implementing Life Cycle Assessment (LCA) Method	Oak desk	Indonesia	Quantify cradle-to-gate impacts of one desk and identify cleaner production actions.	Cradle-to-gate from raw-material delivery through kiln drying, table production and packaging/product ready to ship.	1 product unit (one desk/table).

[6] Medium Density Particleboard

Author(s)	Title	Furniture product/process covered	Geographical application	Main goal	System boundary	Functional/declared unit
Li, S.; Yuan, Y.; Wang, J.; Guo, M. (2019)	Do Novel Wooden Composites Provide an Environmentally Favorable Alternative for Panel-type Furniture?	Double-door wardrobe	China	Compare the environmental performance of a wardrobe made from lignosulfonate/wood-fibre composite with a conventional MDF wardrobe and evaluate improvement scenarios.	Cradle to grave, including transportation to final user. Use is excluded; transportation associated with waste disposal is included; alternative EoL scenarios are considered.	1 wooden wardrobe, 100 kg.
Linkosalmi, L.; Husgafvel, R.; Fomkin, A.; Junnikkala, H.; Witikkala, T.; Kairi, M.; Dahl, O. (2016)	Main factors influencing greenhouse gas emissions of wood-based furniture industry in Finland	Eight products: office/student/public chairs, student/office desks, office cabinet, kitchen cabinet	Finland	Assess cradle-to-gate GHG emissions and identify the environmental hotspots.	Cradle-to-gate from raw-material acquisition to finished furniture at the factory; distribution, use and EoL excluded.	One piece of furniture for each of the eight cases.
Medeiros, D.L.; Tavares, A.O.C.; Rapôso, A.L.Q.R.S.; Kiperstok, A. (2017)	Life cycle assessment in the furniture industry: the case study of an office cabinet	Office cabinet made mainly from MDP	Brazil: manufacturing in Bahia; main MDP supply from national suppliers.	Assess environmental performance across the full life cycle and test transport scenarios.	Cradle-to-grave, distribution of the final product included.	1 office cabinet with a sliding door, 900 mm width, 480 mm depth, and 1600 mm height

Author(s)	Title	Furniture product/process covered	Geographical application	Main goal	System boundary	Functional/declared unit
Mirabella, N.; Castellani, V.; Sala, S. (2014)	LCA for assessing environmental benefit of eco-design strategies and forest wood short supply chain: a furniture case study	Wooden school desk	Northern Italy	Assess the environmental profile of an eco-designed school desk and test the benefits of certified wood, short supply chain and other ecodesign choices.	Cradle-to-gate: transports to retailer included; use and final furniture EoL excluded.	1 school desk
Piekarski, C.M.; de Francisco, A.C.; da Luz, L.M.; Kovaleski, J.L.; Silva, D.A.L. (2017)	Life cycle assessment of medium-density fiberboard (MDF) manufacturing process in Brazil	Medium-density fibreboard	Brasil	Identify environmental hotspots in MDF and evaluate improvement scenarios for energy, resin, wood use and transport.	Cradle-to-gate.	1.0 m3 MDF, average thickness 16 mm, density 683 kg/m3 (dry).
Pulansari, F.; Tirkaamiana, D.; Lestari, A.D.A.; Kurniasari, F.; Susanto, I.P.; Jie, F. (2026)	Holistic strategy for sustainable supply chains: Integrating the purchasing portfolio matrix, supplier relationship management, and life cycle assessment	Oak table	Indonesia; East Java furniture manufacturer and regional supplier network	Integrate supplier relationship management with LCA.	Cradle-to-gate, from procurement of raw materials from suppliers through kiln drying and table manufacturing to packaging / point of distribution.	1 table unit.

Author(s)	Title	Furniture product/process covered	Geographical application	Main goal	System boundary	Functional/declared unit
Russell, J.D.; Huff, K.; Haviarova, E. (2023)	Evaluating the cascading-use of wood furniture: How value-retention processes can contribute to material efficiency and circularity	Three wood-based chairs (Chair A: solid wood; Chair B: upholstered; Chair C: solid wood frame, plywood seat and backrest)	United States	Quantify how value-retention processes such as direct reuse, repair and refurbishment can extend furniture service life, reduce new-material requirements and affect environmental impacts.	Cradle to gate, including direct reuse, repair/refurbishment, component replacement.	1 chair unit for each of the three products, with 10-year initial lifespan.
Sakib, M.N.; Kabir, G.; Ali, S.M. (2024)	A life cycle analysis approach to evaluate sustainable strategies in the furniture manufacturing industry	Pinewood table	Canada	Conduct a LCA and cost analysis for a pinewood table, compare a base process with five improvement strategies and identify cost-effective emission-reduction measures.	Cradle-to-grave, distribution and recycling/management of returned or used products included..	1 unit of pinewood table with a mass of 4.3 kg.

Author(s)	Title	Furniture product/process covered	Geographical application	Main goal	System boundary	Functional/declared unit
Tessitore, S.; Testa, F.; Di Iorio, V.; Iraldo, F. (2025)	Life cycle assessment as an enabler of an environmental sustainability strategy evolution amid institutional pressures: A best practice from the furniture industry	Wood and laminate single-seat office desks	Italy; Milan-based office-furniture company, international markets	Analyse how LCA can drive the transition to Life Cycle Management, using two office desks as the technical evidence base.	Cradle-to-grave	1 single-seat office desk providing a work surface for 15 years and meeting EN 527-1/EN 527-2; reference flow = one office table supplied with packaging.
Wan, R.; Xiong, X.; Fu, S.; Xiong, D.; Xu, X. (2025)	Life cycle assessment and optimization scenarios of sofas: a case study in China	Single leather sofa; seven alternative material and energy scenarios	China: sofa manufacturing and supplier data from Jiangsu/Zhejiang context; Chinese distribution..	Quantify cradle-to-grave environmental impacts of a locally manufactured sofa, identify hotspots and compare optimization scenarios.	Cradle-to-grave, use phase excluded. Capital equipment/infrastructure and business/employee travel are excluded.	1 sofa for one individual, following PCR.
Wang, J.; Belleville, B.; Li, W. (2026)	Life Cycle Assessment of Pyrolysis Valorisation for End-of-Life Medium-Density Fibreboard	End-of-life MDF panel	Australia	Generate LCI for EoL-MDF pyrolysis using Aspen Plus and compare its environmental performance with incineration for energy recovery.	End-of-life treatment system. Pyrolysis: pretreatment, pyrolysis and biogas combustion; incineration: pretreatment and incineration with energy recovery.	Disposal of 1,000 kg of end-of-life MDF

Author(s)	Title	Furniture product/process covered	Geographical application	Main goal	System boundary	Functional/declared unit
Yang, D. (2022)	The Application of Life Cycle Assessment in Sustainable Furniture System Design	No product specific analysis	International (literature review)	Define sustainable furniture design strategies based on a systematic literature review of former LCA analysis.	The review organizes literature into pre-production, production, distribution, use and disposal stages.	Not esxplicitly reported.
Yang, D.; Zhou, M.; Liang, S.; Ma, K. (2025)	Furniture Product Eco-Design Based on Life Cycle Assessment	Three seating stools/benches	Product information is drawn from EPDs	Compare life-cycle impacts of three seating products made from different material systems and use the results to derive eco-design priorities.	Cradle to cradle	A stool providing one user with one year of use.
Yang, D.; Vezzoli, C.; Su, H. (2025)	Comprehensive life cycle assessment of 25 furniture pieces across categories for sustainable design	25 furniture pieces across 8 categories	Global	Generates a database with all 25 furniture pieces' environmental performance data. .	Cradle to grave	Specific for the different products

Author(s)	Title	Furniture product/process covered	Geographical application	Main goal	System boundary	Functional/declared unit
Yılmaz, E.(2024)	Environmental impact assessment of melamine coated medium density fiberboard (MDF-LAM) production and cumulative energy demand: A case study in Türkiye	Melamine-coated MDF production and lamination	Turkey	Quantify cradle-to-gate impacts and cumulative energy demand for MDF production in Türkiye and identify hotspots.	Cradle to gate	1 m3 MDF

9.2. Annex II – List of LCI databases

As described in Section 4, the identified datasets and databases for LCA modelling include the core EF3.1 database, the forthcoming datasets developed in the framework of the ongoing PEFCRs on Hotel accommodation, and country specific databases. Among these, the Italian National Database[7] has been further investigated, as it provide specific datasets for furniture materials, semifinished product and final products/component. An overview of the furniture-specific datasets is provided in **Table 9-2**.

Table 9-2 Overview of the furniture-specific datasets included in the Italian National LCI database.

Dataset	Reference year	Representativeness	Intended use
Monocoque wooden school chair, at production	2021	Italy. Primary data collected in Veneto. Dataset representative of Italian production of monocoque wooden school chairs	The product is used in schools, especially in classrooms for primary and secondary schools as well as common areas such as libraries, study rooms, teachers' rooms, etc.
Poplar plywood panel, at production	2021	Primary data collected in Lombardia. Dataset representative of Italian production of poplar plywood panels.	The product can be used as a component of household and school/office furniture as well as for recreational vehicles (caravans, campers).
Wood veneer, dyed, at production, European wood species	2022	Italy. Primary data collected in Lombardia. Dataset representative of Italian production of dyed wood veneers.	Dyed wood veneer in sheets of variable length and width, which can be used for veneering of suitable specific supports (MDF, honeycomb panel, chipboard, multilayer, ...), or to create other specific products (such as plywood, boards, …)

[7] https://bancadatiitalianalca.enea.it/Node/processList.xhtml?stock=DB_ARCADIA

Dataset	Reference year	Representativeness	Intended use
Wood veneer, dyed, at production, extra-European wood species	2022	Italy. Primary data collected in Lombardia. Dataset representative of Italian production of dyed wood veneers.	Dyed wood veneer in sheets of variable length and width, which can be used for veneering of suitable specific supports (MDF, honeycomb panel, chipboard, multilayer, ...), or to create other specific products (such as plywood, boards, …)
Wood veneer, dyed, at production, Italian wood species	2022	Italy. Primary data collected in Lombardia. Dataset representative of Italian production of dyed wood veneers.	Dyed wood veneer in sheets of variable length and width, which can be used for veneering of suitable specific supports (MDF, honeycomb panel, chipboard, multilayer, ...), or to create other specific products (such as plywood, boards, …)
Wood, recycling	2022	Lombardy Region	Recycling of wood
Single-seater school desk, at production	2021	Italy. Primary data collected in Veneto and Abruzzo. Dataset representative of Italian production of single - seater school desks.	The product is used in schools, especially in classrooms for primary and secondary schools as well as in common areas such as libraries, study rooms, teachers' rooms, etc.
Office table, Production and disposal of office table	2018	IT	The dataset has been developed in LIFE EFFIGE project. Details are given in “PEFCR of Office table”. In a cradle to grave approach, the dataset includes the all input and output for the production of 1 office table including the end of life of its materials.

Dataset	Reference year	Representativeness	Intended use
Office Chair , Production and disposal of office chair	2018	IT	The dataset has been developed in LIFE EFFIGE project. Details are given in “PEFCR of Office chair”. In a cradle to grave approach, the dataset includes the all input and output for the production of 1 office chair including the end of life of its materials.

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