Life Cycle assessment

Methodology

Tikamoon

To be able to perform the LCAs on selected Tikamoon products in a timely and accurate manner, the tool éco-meuble has been selected. Eco-meuble has been developed by ADEME and the technological institute Forêt Cellulose Bois-construction Ameublement (FCBA) to allow companies to perform LCAs and get a grade, between A and E, for the product. This LCA tool is designed to put in place an environmental label, for furniture products, to give accurate and understandable information to the consumer. The environmental label to affix on some products is currently in the testing stage. It focuses on three major impacts, climate change, freshwater eutrophication, and acidification, identified as the main impacting steps for furniture products during the first phase of the project. Today, the grading system is not yet specified as the different thresholds for each impact's category have not been set. As a standard LCA tool, results for each impact's category, globally, and each life cycle step, are provided and can be exported.

The database used is the "base-impact" created by the ADEME in partnership with FCBA and several industry companies, information is taken from past projects and/or existing database such as GaBi, and are all complying with the ISO norm for LCA data. This database is publicly available, standardized, and follows the Product Environmental Footprint guidelines developed by the EU.

The boundaries of the LCA study are cradle to grave: from the extraction of the raw material until the end of life (See Figure 4). The forest management type will be considered. The steps analyzed are Raw material extraction and first transformation, Second transformation, Distribution, and End of life. The three impact categories selected are Global warming potential, Freshwater eutrophication, and Acidification.

This study LCA has been done following the requirements outlined in ISO 14040 and 14044. This paragraph will present the detailed description of the methodology used, and in particular: the goal of the LCA, the functional unit, the reference flow, the system boundaries, the choices made for the modeling approach, the modeling tool and database, impact assessment method, assumptions, and limitations.

This study will be used by Tikamoon to assess the environmental impacts of its sourcing choices regarding production locations and raw material choices as well as product transport means. It will additionally help choose and design key performance indicators to put in place at Tikamoon.

1.1. Goal Definition

The goal of this study is to provide accurate information on the environmental impacts of wood-based furniture to Tikamoon and to gather data to assess the mitigation potential of wood-based furniture. The aim of the study is:

- Identify the best raw material for furniture
- Identify the life cycle steps having the biggest impact on the Global Warming potential
- Identify the lifespan needed for the furniture to have a beneficial Global Warming impact and in what extend is the lifespan important.
- Compare different references and different versions

The scenarios studied are either currently in place at Tikamoon or in the development stage.

1.2. Functional unit

The functional unit definition in an LCA study is essential as to be the basis of a fair comparison in between references and scenarios. In this study, the furniture categories analyzed are vanity cabinets, storage unit besides bookshelves, tables, coffee tables, and chairs.

Vanity cabinet

The functional unit defined follows the requirement of ADEME. For vanity cabinets, the functional unit is defined as "To have 1 dm^3 of storage space for one year" with the volume being defined as the total product volume. (*General principles for environmental communication on mass market products - Part 4: environmental impact methodology for furniture products*, ADEME, 2016)

Storage unit

The functional unit defined follows the requirement of ADEME. For vanity cabinets, the functional unit is defined as "To have 1 dm^3 of storage space for one year" with the volume being defined as the total product volume. (*General principles for environmental communication on mass market products - Part 4: environmental impact methodology for furniture products*, ADEME, 2016)

Table

The functional unit defined follows the requirement of ADEME. For vanity cabinets, the functional unit is defined as "To a useful surface for one year" with the useful surface defined as the minimum space between the perimeter divided by 60 cm and the table surface divided by 2400 cm^2 (60 x 40 cm^2), rounded down to the nearest whole number. (*General principles for environmental communication on mass market products - Part 4: environmental impact methodology for furniture products*, ADEME, 2016)

Coffee table

The functional unit defined follows the requirement of ADEME. For vanity cabinets, the functional unit is defined as "To have 1 dm^2 of useful top horizontal surface for one year. (*General principles for environmental communication on mass market products - Part 4: environmental impact methodology for furniture products*, ADEME, 2016)

Chair

The functional unit defined follows the requirement of ADEME. For vanity cabinets, the functional unit is defined as "To have one sitting place at least 50 cm wide for one year" with the sitting area as a minimum of 50 cm wide when the product is advertised as accommodating at least two people. (*General principles for environmental communication on mass market products - Part 4: environmental impact methodology for furniture products*, ADEME, 2016)

1.3. Reference flow

The reference flow reflects the functional unit to one piece of furniture, the amount of product required to provide the service. It is then calculated for each piece of furniture studied. Here the formula used is as follow:

$$R_f = \left(\frac{1}{l_s}\right) * P_u \quad (1)$$

In this formula, R_f is the reference flow (dimensionless), l_s the piece of furniture lifespan (years), and P_u the product unit (dm^{-3}, dm^{-2},…).

The lifespan is typically defined by ADEME uniquely on mechanical properties, with a standard default one set at 5 years. This value will be challenged as, according to the literature review, it is one of the key parameters to differentiate the impacts and the capacity for the HWP to lock away carbon and have an impact on climate change.

$$P_u = \frac{F_u}{V} \quad (2)$$

With F_u being the functional unit (dimensionless) and V the volume of the piece of furniture (dm^{-3}, dm^{-2},…).

1.4. System boundaries

The LCA is performed on a cradle to grave basis on a 100 years' time horizon. The boundaries are, as presented below, from the extraction of the raw material to the end of life of the piece of furniture. It includes the production of energy and material resources needed for the production of the piece of furniture. The packaging was excluded from the study as it represents < 5% of the total weight and is difficult to modelized in our case. The use phase is also excluded as there is no flow in the furniture context. R&D, employee transports, and product-related services are also excluded due to the difficulty to allocate these flows to the product. The flow locations up to the Warehouse are dependent on the scenarios while the downstream transport and end of life are set to occur in France.

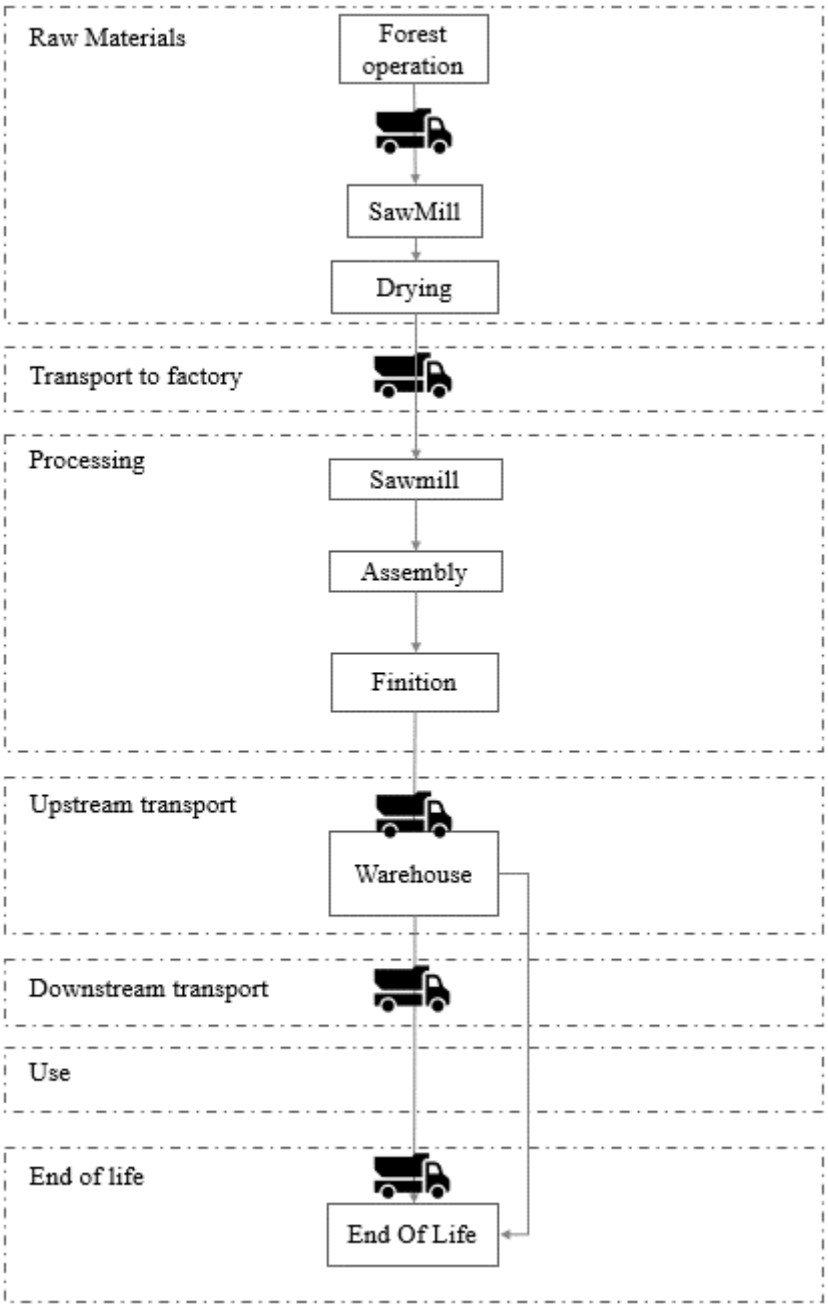

Figure 0.1 LCA system boundaries

1.5. LCA data

1.5.1.Data Collection

A data collection campaign was launched in 2020 to Tikamoon's supplier. The data collection sheet used can be seen in Annex 1. Incoming raw materials weights, as well as the amount of waste and energy used, was required. The bill of material and technical drawing was also collected. The collection of emission data was too difficult and so the modeling is based on datasets.

1.5.2.Datasets

Datasets used in this study are extracted from the publicly available Base Impact and were used for all the flows to stay consistent. The version of the Base Impact used was 2.0.1, published on July 24th, 2020. The table below shows the list of datasets used:

Table 0.1 Datasets used in the LCA

Flows	Dataset names	Units
Raw material	Hardwood lumber, 1 inch, sustainable forestry, 1kg, RER	kg
Raw material	Hardwood lumber, 1 inch, unsustainable forestry, 1kg, RER	kg
Raw material	Particleboard, melamin coated, inside furniture, unsustainable forestry, 1kg, RER	kg
Energy	Electricity grid mix, CN	kWh
Energy	Electricity grid mix, IN	kWh
Energy	Electricity grid mix, CR	kWh
Energy	Electricity grid mix, HR	kWh
Transport	Ocean container transport 27,500 t (incl. infrastructure fleet and use) (100%) [tkm], GLO	t*km
Transport	Truck transport (incl. infrastructure fleet and street) (50%) [tkm], GLO	t*km
Transport	34-40t (25t) France: Truck transport (incl. infrastructure fleet and street) (50%) [tkm], FR	t*km
Transport	7,5t (3t) France: Truck transport (incl. infrastructure fleet and street) (50%) [tkm], FR	t*km
Transport	Train transport (incl, infrastructure fleet and use) [tkm], FR	t*km
Transport	Train transport (incl, infrastructure fleet and use) [tkm], IT	t*km

The modelisation is internal to the eco-meuble tool and not publicly available. Some other datasets can be used depending of this modelling.

1.6. Environmental impact indicators

Three environmental impacts have been selected to be assessed in this study, following the ADEME selection for furniture products, Climate change, water pollution, and Air and soil pollution as presented in the table below (*General principles for environmental communication on mass market products - Part 4: environmental impact methodology for furniture products*, ADEME, 2016):

Table 0.2 Environmental impacts considered in the LCA

Environmental impacts	Impact indicators	Units used
Climate change	Greenhouse gas emission	kg of CO^2 eq
Water pollution	Freshwater eutrophication	kg of P eq
Air and soil pollution	Acidification	Mol of H^+ eq

Data origin: (*General principles for environmental communication on mass market products - Part 4: environmental impact methodology for furniture products*, 2016)

1.7. End of life

The end of life will be modelized following the furniture end-of-life in France. According to éco-mobilier, the French situation for furniture end of life is: 68% of the furniture products are recycled, 21% are used to produce energy and substitute fossil one and the rest is landfilled.

Annex 1

Production Step				
Made by:		Date:		
	Process:			Site (Supplier/Location):
Period Year:		Month (start):		Month (end):
Description of the process:				
Incoming material	Unit	Quantity	% Loss	Data origin and calculation method
Water consumption (1)	Unit	Quantity	Data origin and calculation method	
Incoming energy (2)	Unit	Quantity	Data origin and calculation method	
Material exiting	Unit	Quantity	Data origin and calculation method	
	Note:			
	(1): Potable water, surface water, … (2): Gas, petrol, charcoal, biomass, electricity, …			

Transport Step		
Made by:	Date:	
Transport:		Site (Supplier/Location):
Transport Type		Distance