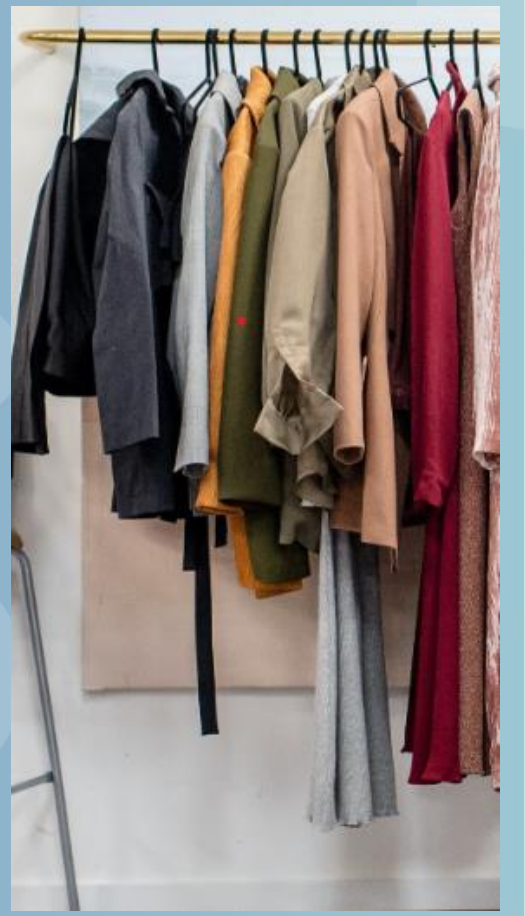
Preparatory Study on Textiles for product policy instruments



2nd Online Stakeholder Consultation Meeting – Day 2
10 December 2024

Joint Research Centre (JRC)

Antonio DELRE, David BERNAD BELTRAN, Zahara PÉREZ ARRIBAS,
Vincenzo SENATORE, Viktor KOULOUMPIS, Paola ALBIZZATI, Enrique GARCÍA JOHN, Fulvio ARDENTE

European Commission

Framework of the environmental and economic model

- LCA & LCC in the preparatory study
- Details on the Life cycle Inventory

European Commission

Presentation structure

Part 1:

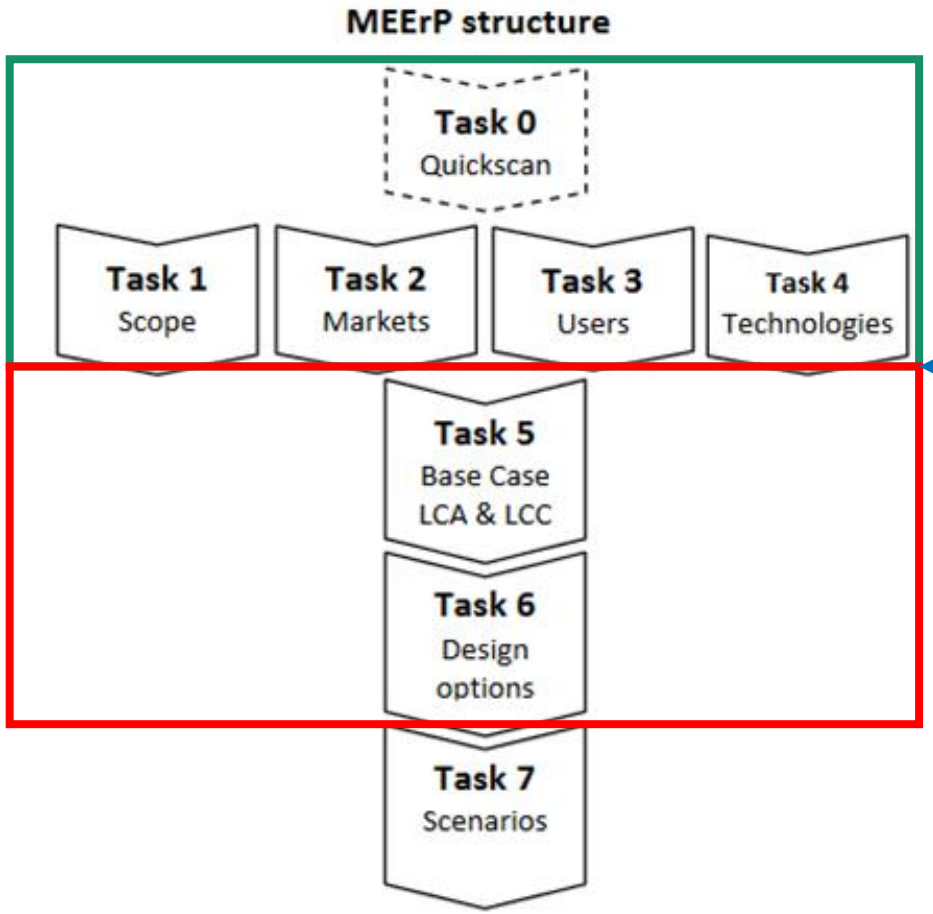
- General context
- Overview of Life Cycle Assessment
- Framework of the LCA/LCC model
- How to contribute?
- Questions and answers

Part 2:

- Details on Gaps in Life Cycle Inventory
- Next steps
- Questions and answers

PART 1:
LCA & LCC in the preparatory study

Methodology for the Ecodesign of Energy-related Products (MEErP)



Currently in preparation for:
Task 5 Base case LCA & LCC
Task 6 Design Options

General context – preparation for Task 5

- This presentation is focused on illustrating the proposed **framework for both LCA and LCC**

- This framework should serve as a basis for assessing the **products in the scope** (i.e. does not necessarily refer to a specific textile apparel product)

- **Work in progress concerning LCA/LCC will be illustrated,** giving the opportunity to stakeholders to provide early inputs especially concerning:
  - The framework, including **basic assumptions and values**
  - **Data gaps** to be filled
  - **Additional feedback for dedicated aspects**

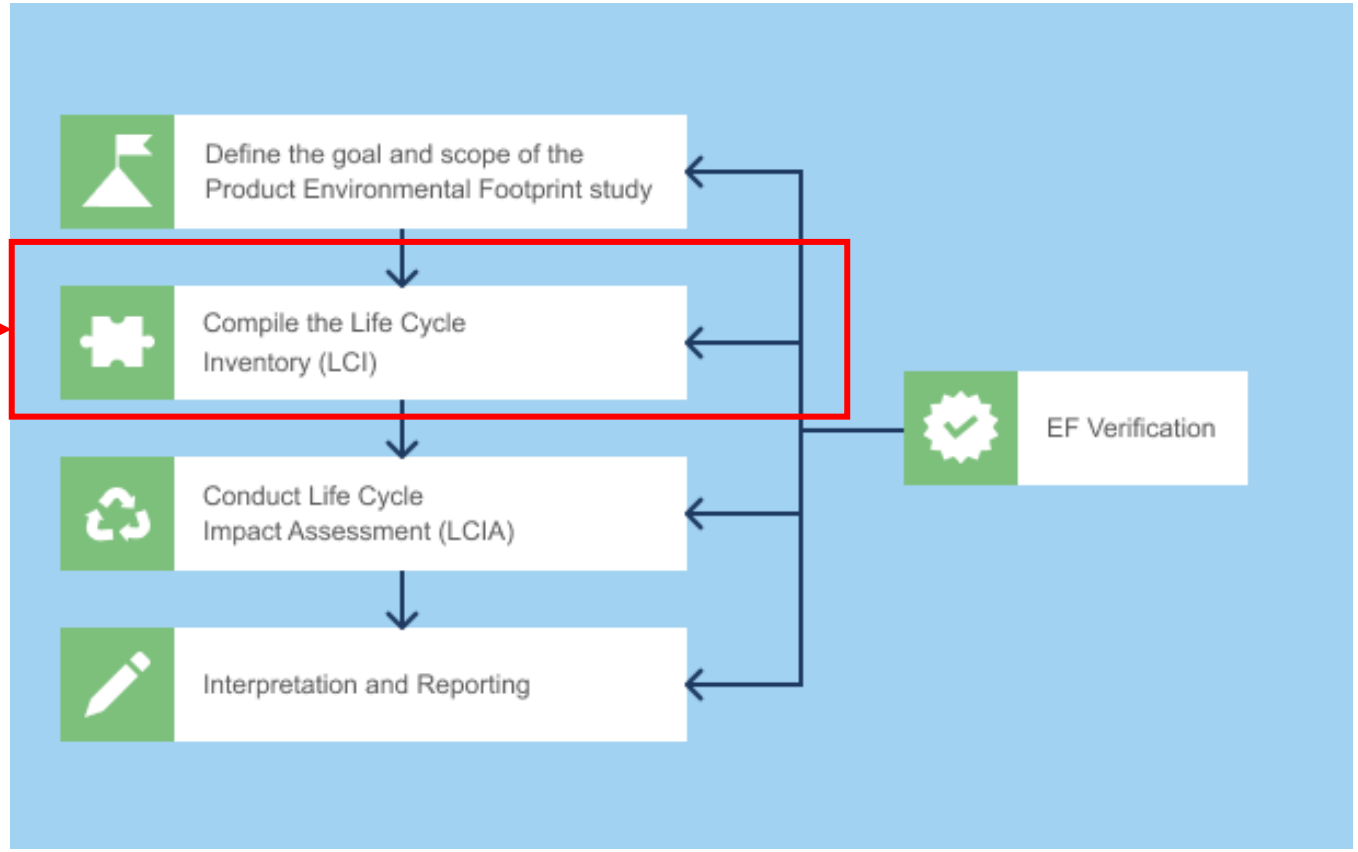
- Task 5 (on Base case LCA/LCC) and Task 6 (on Design options) will be presented in a **3rd consultation, including full models and results**

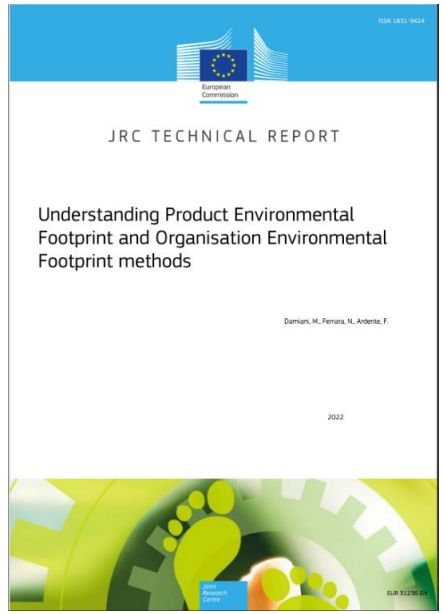
Scope of LCA / LCC

No shifting environmental burdens between life cycle stages or impacts

European Commission

LCA study phases (based on PEF)





COMMISSION RECOMMENDATION

of 16.12.2021

on the use of the Environmental Footprint methods to measure and communicate the life cycle environmental performance of products and organisations

European Commission

Conduct Life Cycle Impact Assessment

Environmental Impacts covered

Results for categories separately and as a single score

+

Economic Impacts covered

- Environmental life cycle costs[α]
- Full environmental life cycle costs[β]

[α]Inclusion of CAPEX, OPEX and internalised environmental costs
[β]Extension of environmental life cycle costs with monetised, non-internalised environmental costs

European Commission

Interpretation and reporting

The purpose of this analysis is to identify the **most relevant – hotspot analysis**:

- **Impact Categories** (e.g. Climate change)
- **Life cycle stages** (e.g. Manufacturing)
- **Processes** (e.g. Copper mining)
- **Elementary flows** (e.g. Methane CH4)

Hot-spot will be then further investigated for the purpose of identifying possible design options

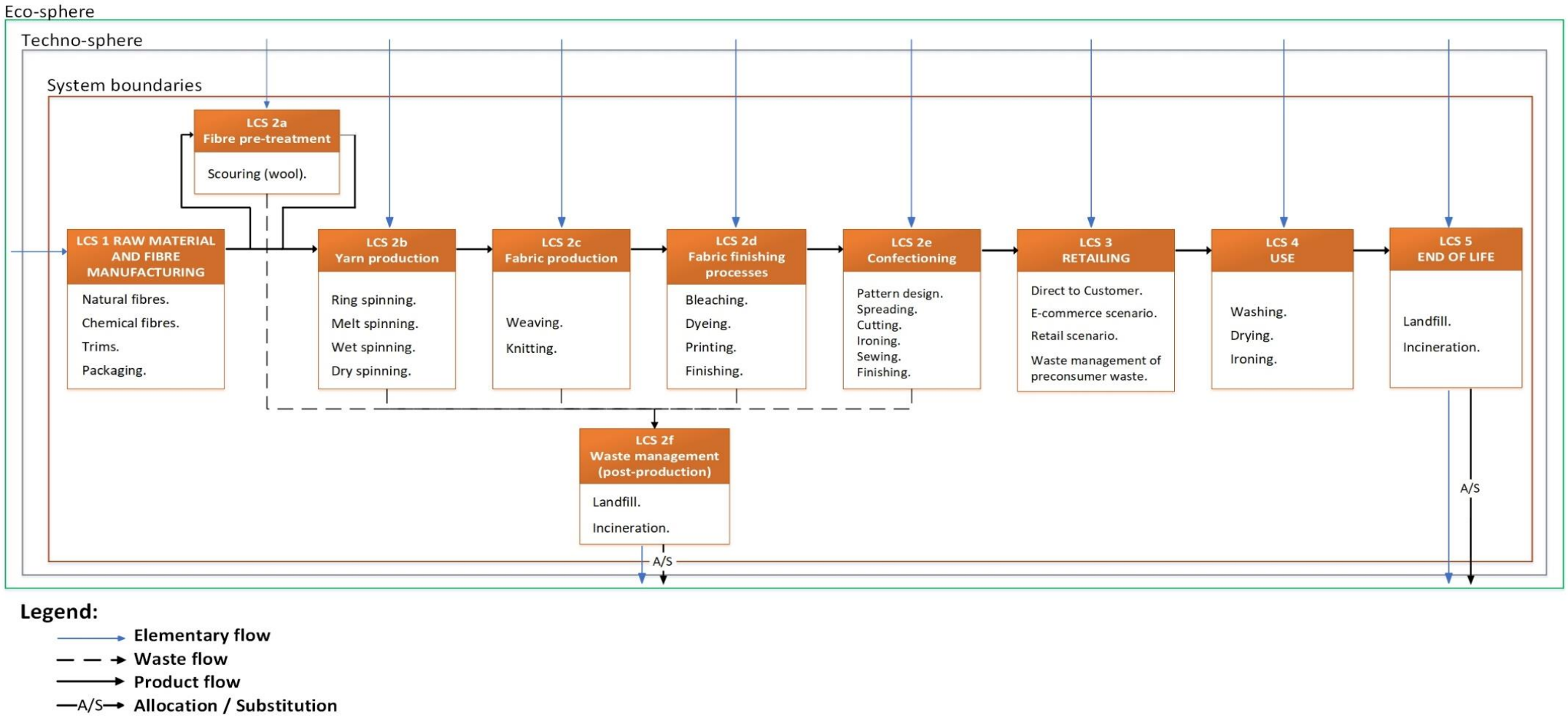
Inputs from PEFCR Apparel & Footwear

Valuable inputs from the PEFCR Apparel & Footwear versions v1.2 and v2.0 have been considered such as:

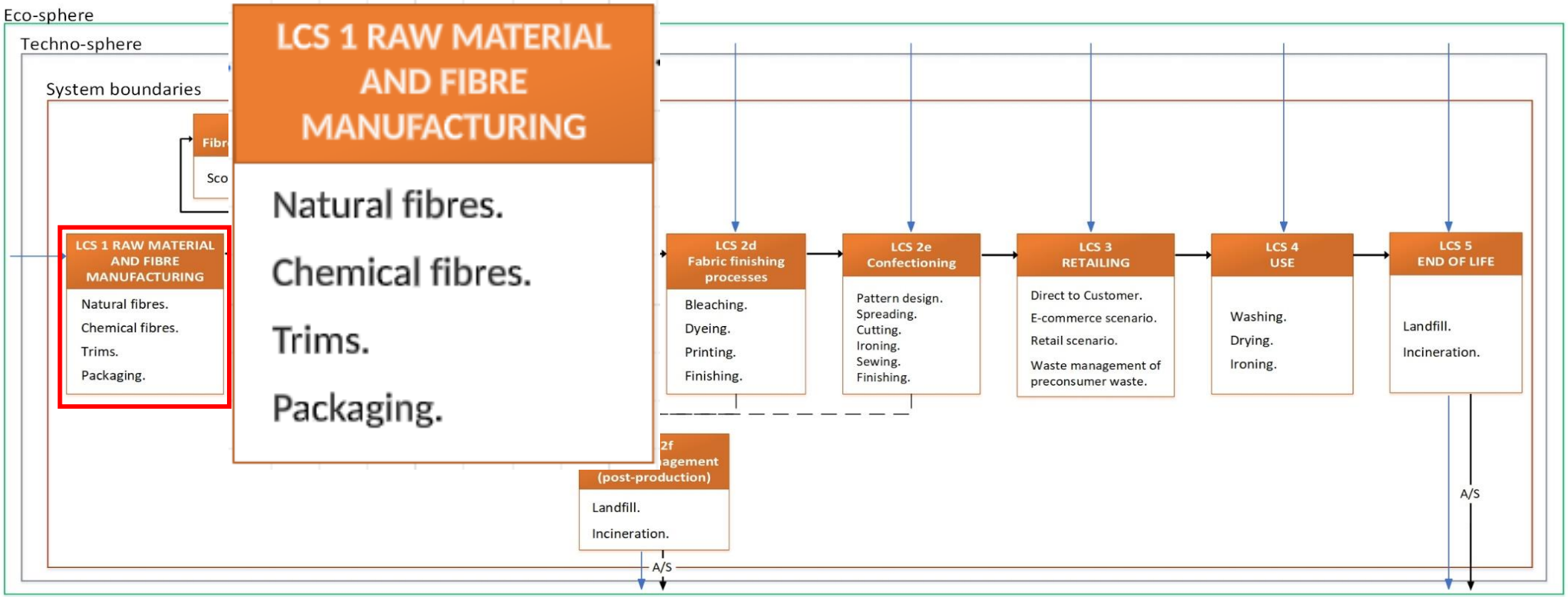
- Pre-treatment process losses
- Retailing (distribution, storage) modelling
- Ironing of garments
- End of Life scenarios
- Bill of materials and product groups
- Number of uses/washes

Used as starting point and then complemented with info from previous stages of the PS

System boundary diagram



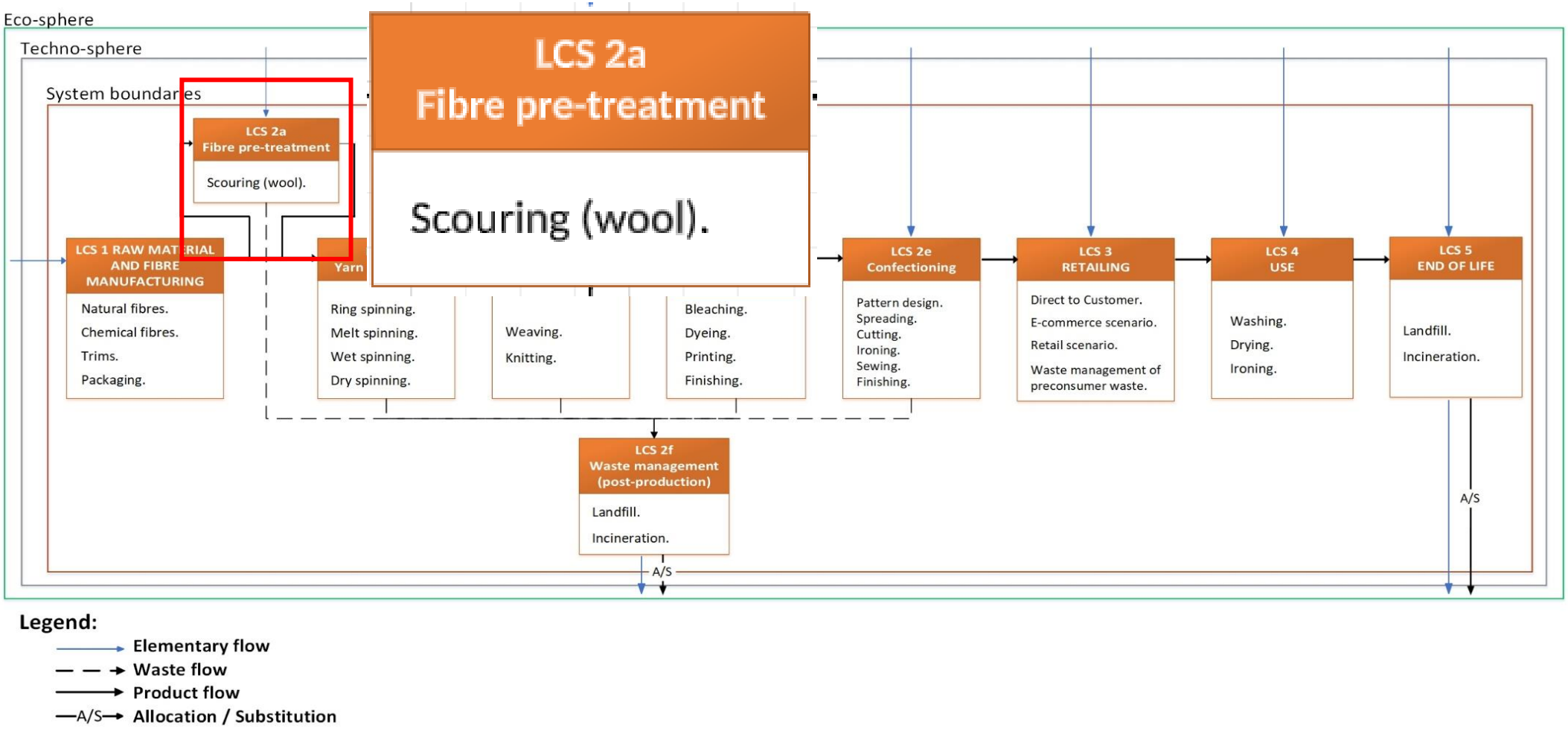
System boundary diagram



Legend:

- Elementary flow
- Waste flow
- Product flow
- A/S Allocation / Substitution

System boundary diagram



Legend:

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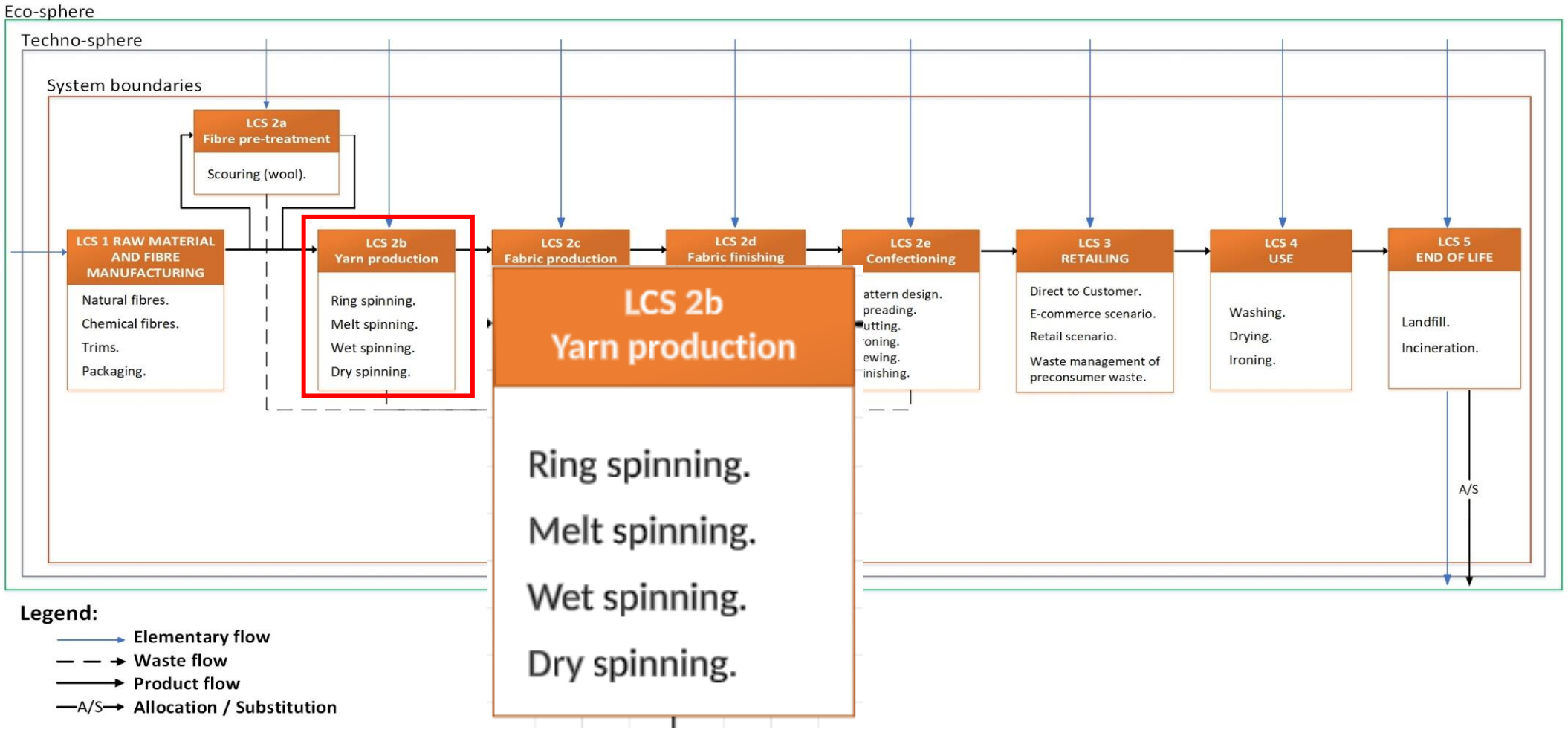
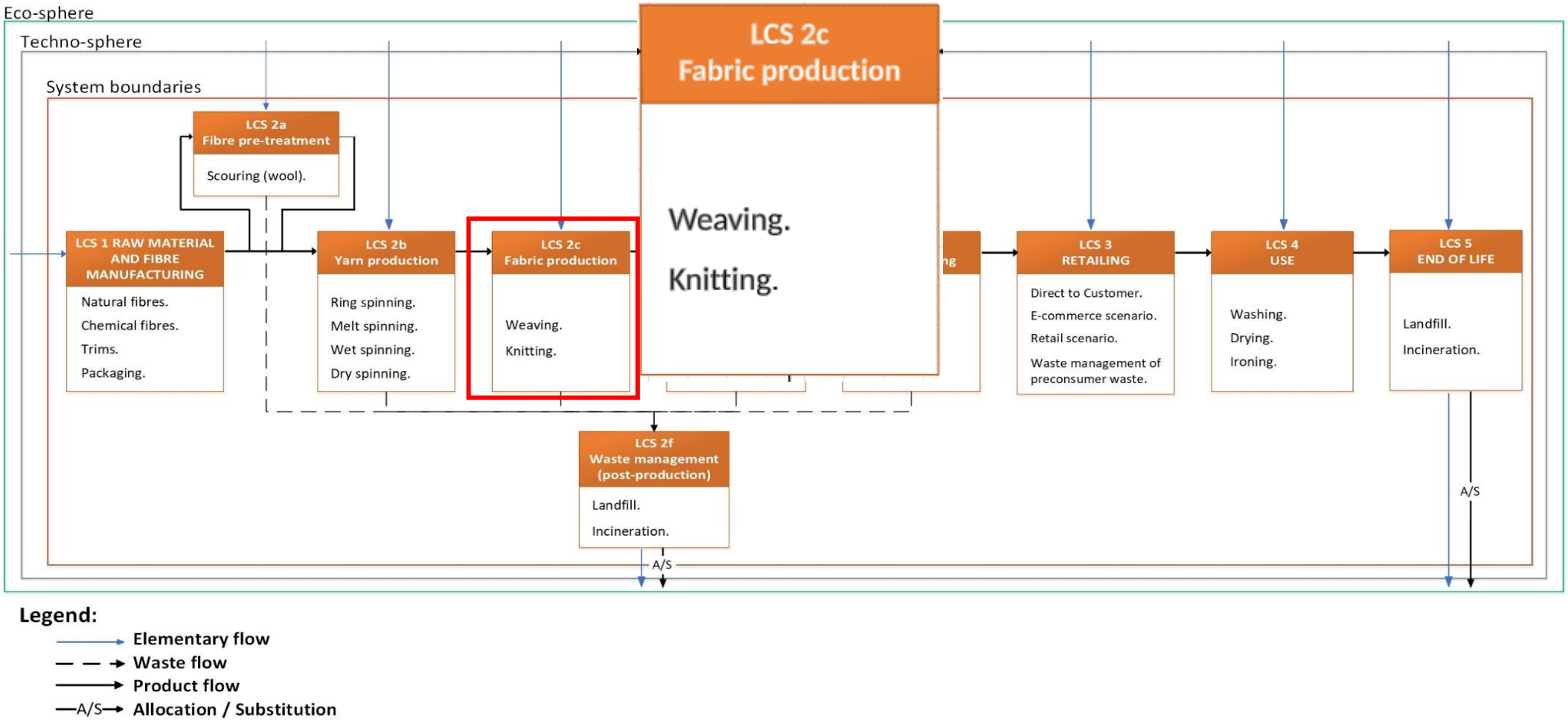
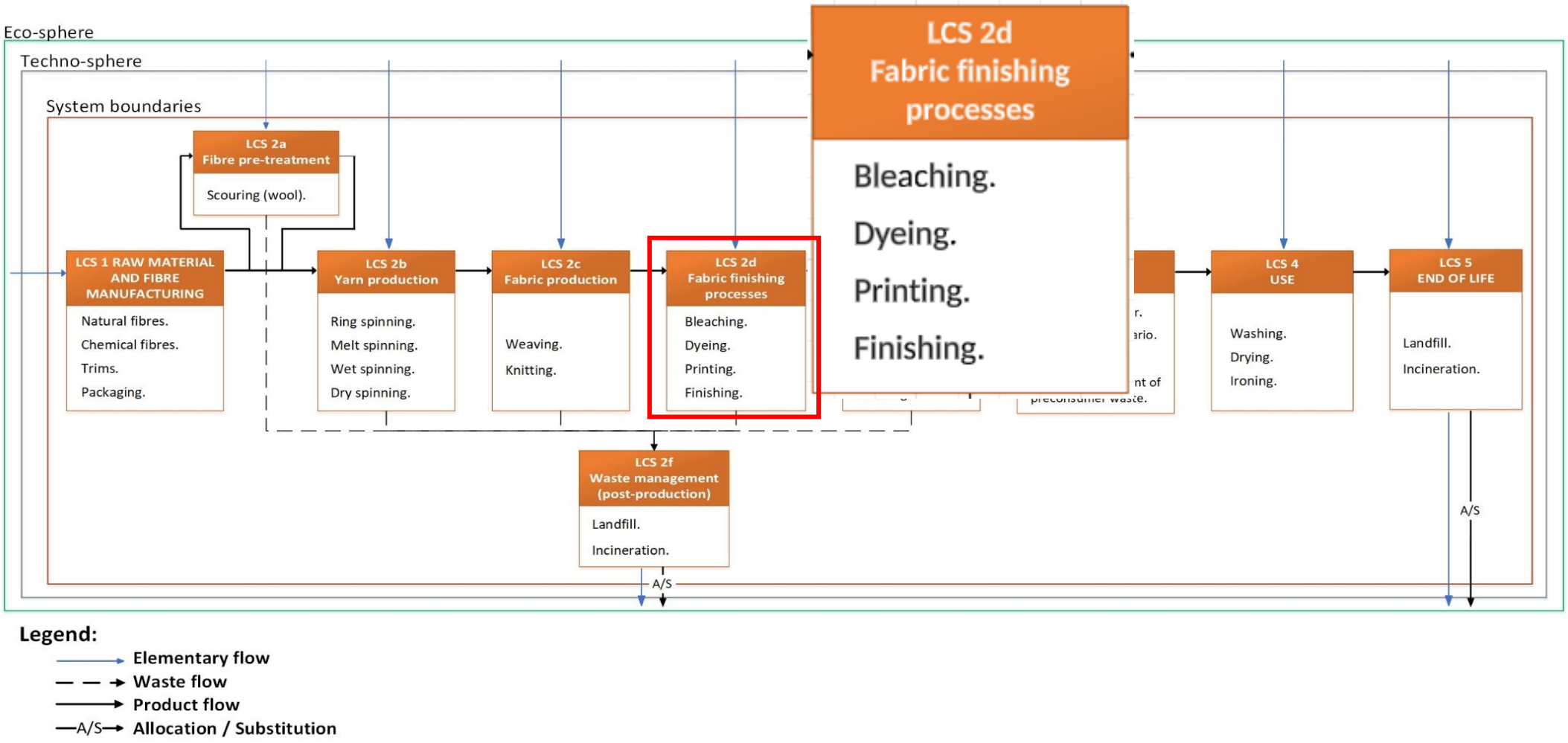
System boundary diagram



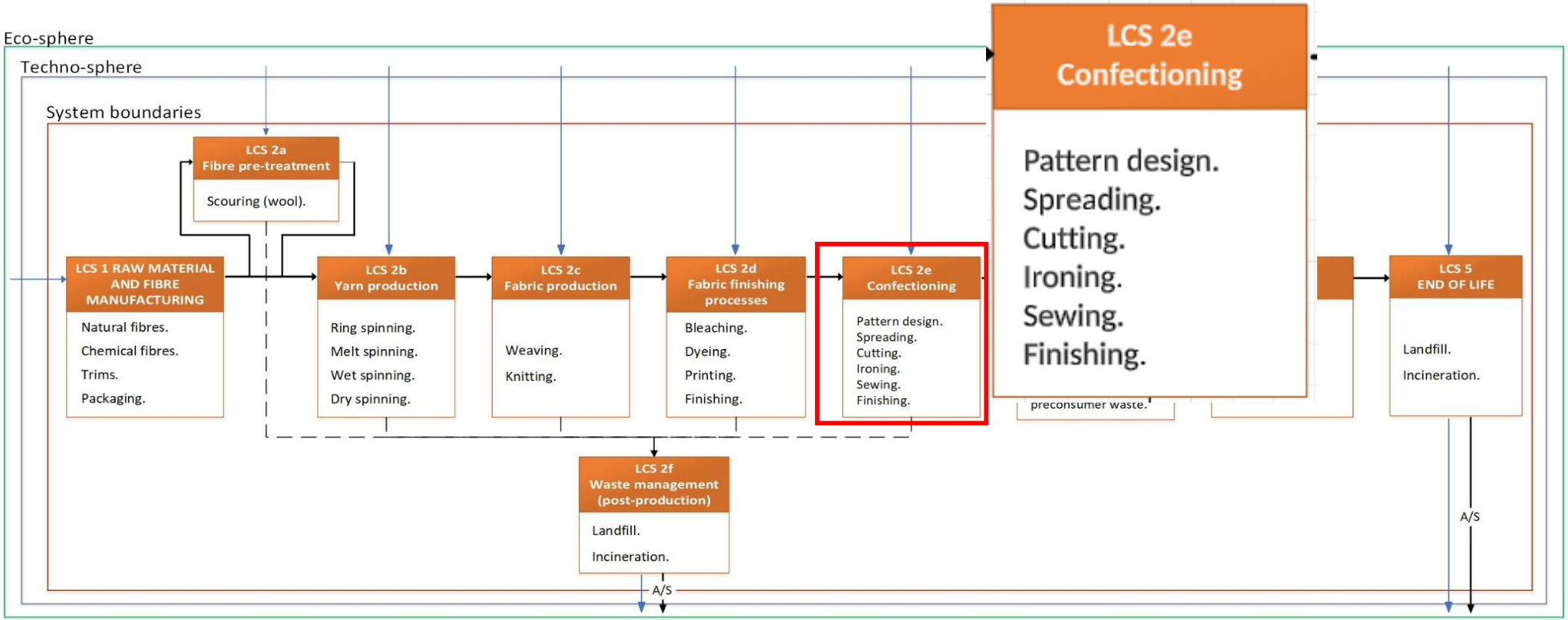
System boundary diagram



System boundary diagram



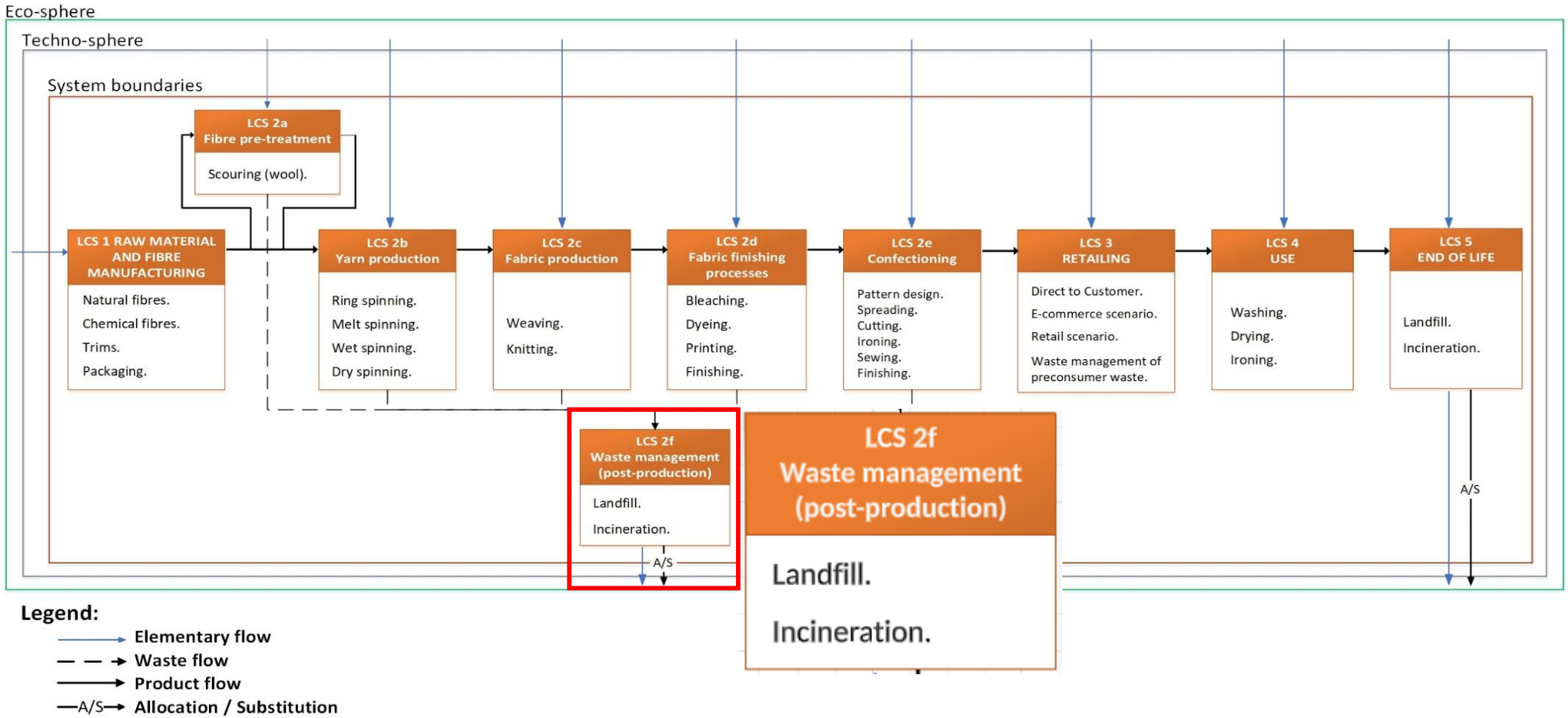
System boundary diagram



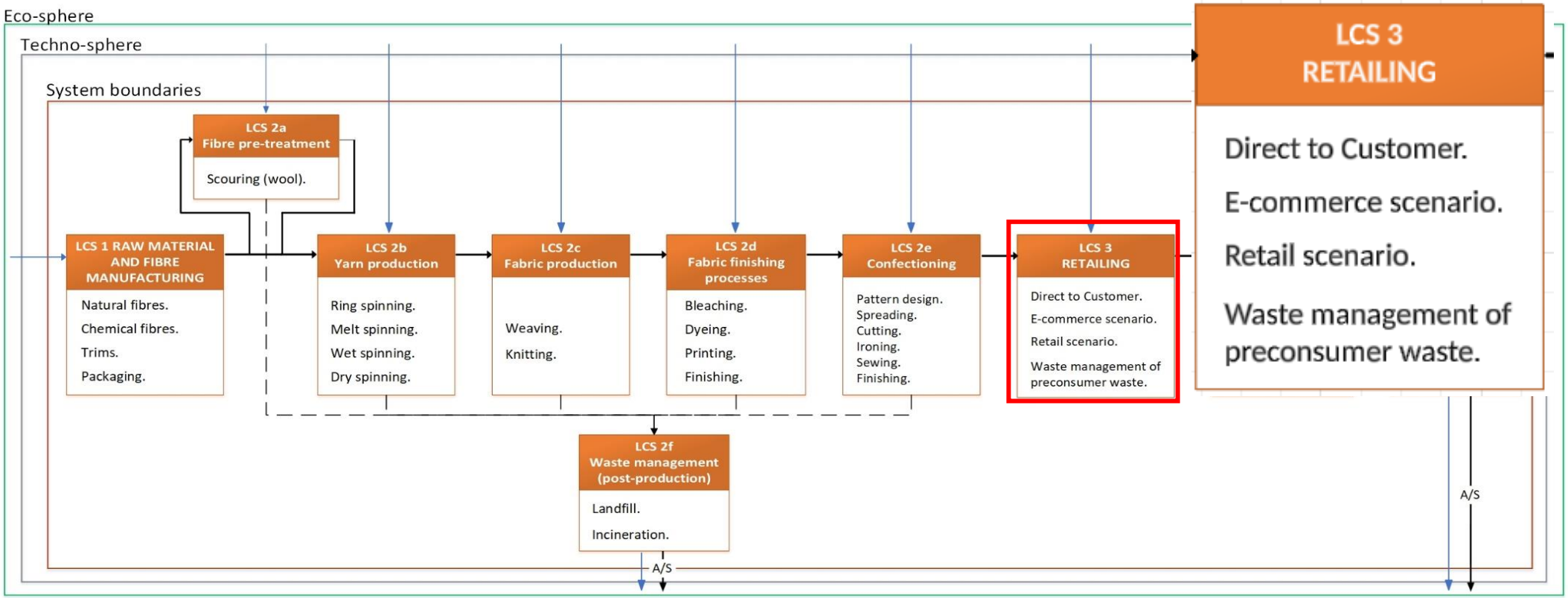
Legend:

- Elementary flow
- Waste flow
- Product flow
- A/S Allocation / Substitution

System boundary diagram



System boundary diagram



Legend:

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- Waste flow
- Product flow
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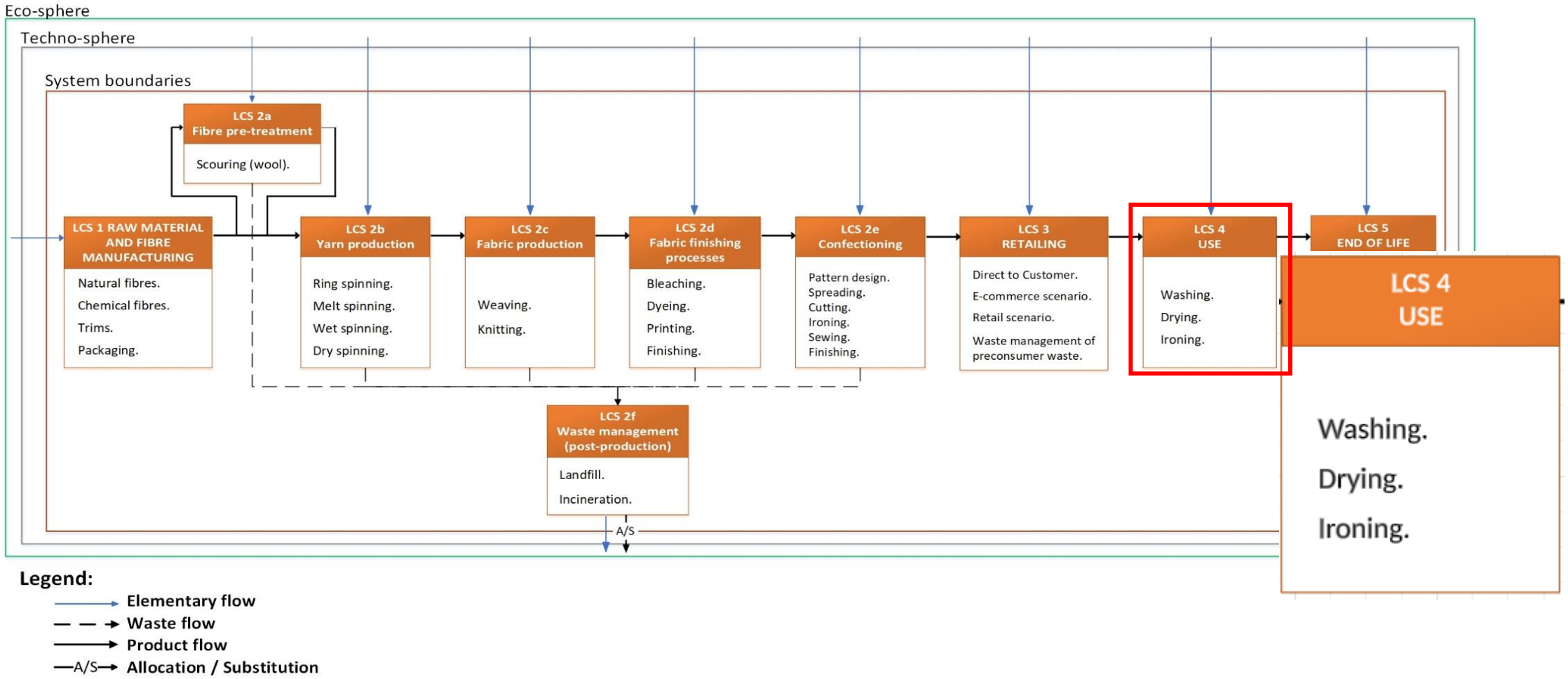
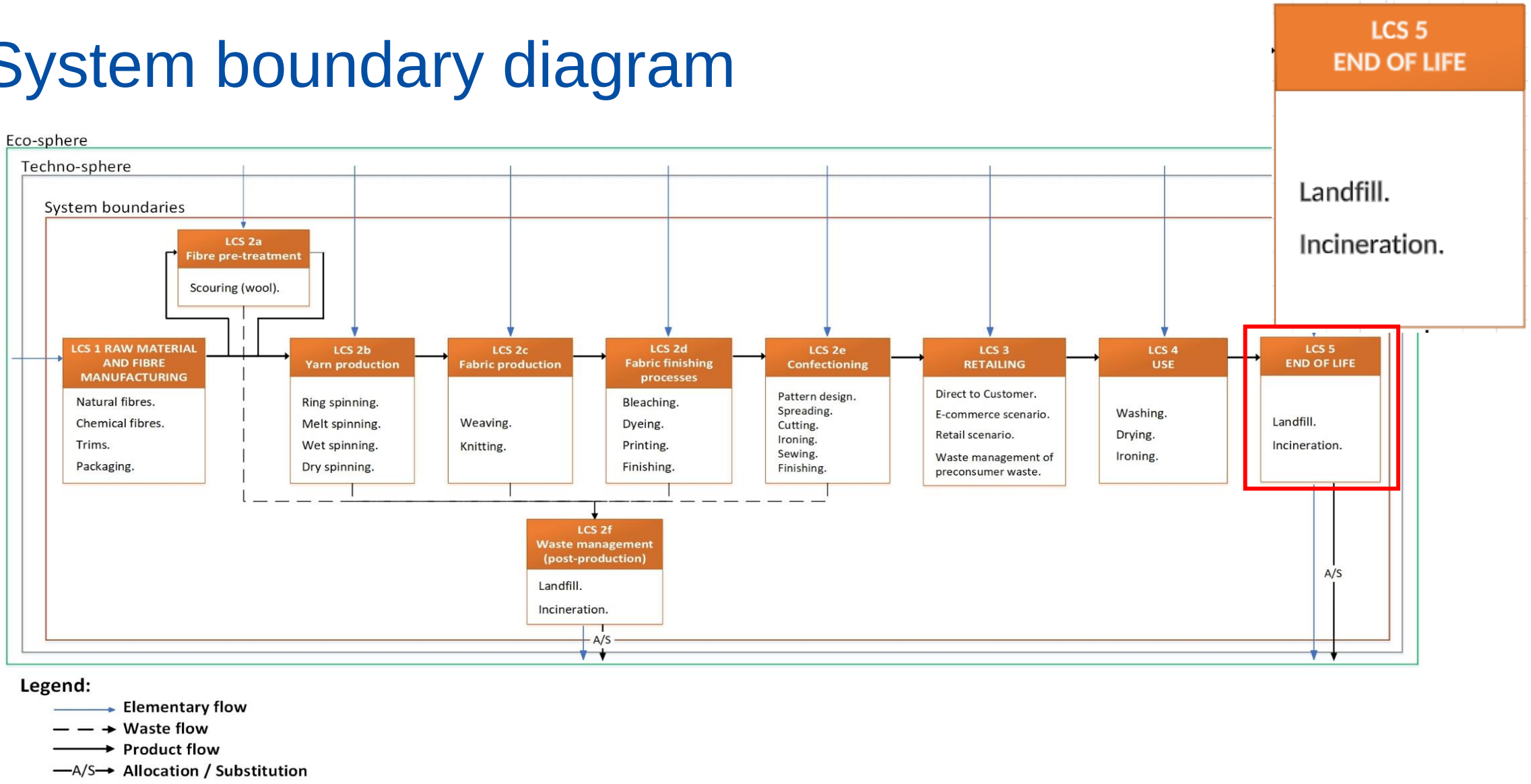
System boundary diagram



System boundary diagram



Main assumptions - exclusions

- No environmental impacts or economic costs are attributed to the warehouse or production plant **buildings.**
- **Capital goods** have been excluded from the assessment in the LCA.
- **Capital expenditures** (CAPEX) have been considered in the LCC.
- Environmental impacts and costs associated with the **operation of the infrastructure** (e.g. HVAC: Heating, Ventilating, and Air Conditioning) are represented by the energy flows only (set as a fixed share equal to 30% of the direct consumption for each process analyzed).
- Material flows in production processes are corrected for the fraction of **losses** that occur at each step.

How to contribute?

- Two documents will be shared (after this meeting) with stakeholders, in addition to this presentation:
  - Document in **Excel** format (where **direct feedback** are expected)
  - Document in **pdf** format (**supporting the Excel**)

- General comments should be provided also within the Excel (in the dedicated sections)

How to contribute? (details)

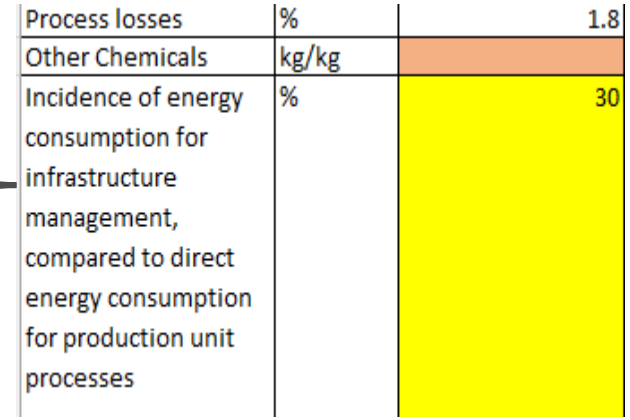
The supporting document:

- Is a guide to:
  - understand the developed model
  - easily identify the sections (e.g. LCS) of the model reported in the Excel
- Provides the detailed inventory for each Life Cycle Stage (LCS) and for each unit process (in LCS 2) (non-editable)
- Presents the structure of the tables that can be filled in the Excel file
- Reports inventoried data and data gaps
- Reports data sources and/or assumptions

How to contribute? (details)

The Excel template:

- Three types of inventory data are provided according to colour coding (this data can be found in the columns identified by the label "Value"):
  - Data in **white cells** refer to data we consider of **higher quality** in terms of:
    - reliability
    - representativeness
    - referenced source
  - Data in **yellow cells** are data which are obtained by referenced sources:
    - wide range of possible values
    - wide range or sources that are providing different values
    - **validation by stakeholders** is welcome
  - Missing data in **orange cells** are **gaps** (for which **inputs from stakeholders are welcome**)



Process losses	%	1.8
Other Chemicals	kg/kg	
Incidence of energy consumption for infrastructure management, compared to direct energy consumption for production unit processes	%	30

How to contribute?

The Excel template:

Fibre pre-treatment (Scouring)					
Name of LCI input/output requirement	**Unit**	**Value**	**Source/Assumption**	**Feedback OR new value**	**Additional comment**
Process losses	%	15	PEFCR Apparel&Footwear v1.2		
Thermal Energy	MJ/kg	2.37E+01	(Roth et al., 2023)	OK	It would be better to use kWh/kg instead of MJ
Water	m3/kg	2.20E-02	(Roth et al., 2023)	0.018	This value should be less than 20 kg/kg. Best estimate would be 18
Wastes	kg/kg	6.80E-03	(Roth et al., 2023)	OK	
Detergent	g/kg	1.02E+01	(Roth et al., 2023)	9.9	
Alkylphenol exthoxylates (APEOs)/ Nonylphenol ethoxylates (NPEOs)	g/kg		(Roth et al., 2023). With specific regard to textile sector, under REACH (Annex XVII entry 46), NPEOs are restricted in textile and leather processing, except when there is no release in waste water. NPEOs are also restricted in textile products that are expected to be washed in water (Annex XVII 46a).	0.025	It is difficult to estimate but based on 'X' it is stated that the content of APEOs in case 'Y' was 0.025 g/kg

How to contribute?

The Excel template:

- **Comments and indications on model features and assumptions will be collected ONLY through the spreadsheet Excel document by using the sheet labelled "Comment and Feedback".**

- Information can be reported by referring to the line number found in this document.

- The spreadsheet Excel document with your comments and indications should be sent to JRC-B5-TEXTILES@ec.europa.eu by the **end of business on 24th of February 2025**

Questions ?

Break

Part 2 :
Details on the Life cycle Inventory

RAW MATERIAL AND FIBRE MANUFACTURING (LCS 1)

The textile fibres most commonly used by the apparel textiles industry:

- **Natural origin fibres:** animal origin (including wool, silk and hair); and vegetable origin (including cotton and flax).
- **Chemical fibres (man-made):** natural polymer fibres / man-made cellulosic fibres (MMCF); and synthetic polymer fibres, like polyester (PES), polyamide (PA), acrylic (PAC), elastane (EL).

Location of production for specific textile fibres. (Source: 1st Milestone of PS, adapted from Textile Exchange, 2022)											
Polyester (PES)		**Cotton**		**Man-made cellulosic fibres (MMCF)**		**Polyamide (PA)**		**Wool**		**Other animal fibres**		**Feedback OR new value**	**Additional comment**
Unknown	70%	Unknown	39%	Unknown	58%	Unknown	81%	Unknown	55%	China	88%		
China	13%	India	23%	China	18%	China	15%	Australia	17%	Unknown	9%		
Others	10%	Others	17%	Others	16%	Taiwan	3%	South Africa	15%	Hungary	2%		
Türkiye	7%	China	13%	India	5%	USA	1%	New Zealand	10%	Poland	1%		
		USA	8%	Indonesia	3%			Others	3%				

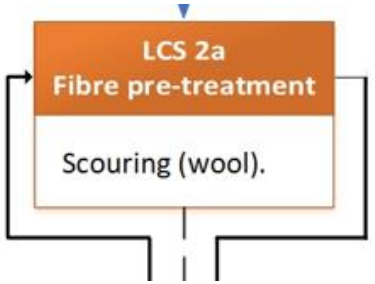
RAW MATERIAL AND FIBRE MANUFACTURING (LCS 1)

Inventory of the Raw materials and fibre manufacturing stage (LCS1).

Data to produce 1kg polyester fibre						
Type of the input	**Name of the input**	**Unit**	**Value**	**Source**	**Feedback OR new value**	**Additional comment**
Chemicals						
Electricity						
Heat						
Resources and materials						
Waste						
Other						
Machine economic value (CAPEX)						
Machine average lifetime (useful life)						
Average process duration						
Employment						
Incidence of energy consumption for infrastructure management, compared to direct energy consumption for production unit processes (where applicable)						

Note: Similar boxes are available for cotton, wool, viscose and PA

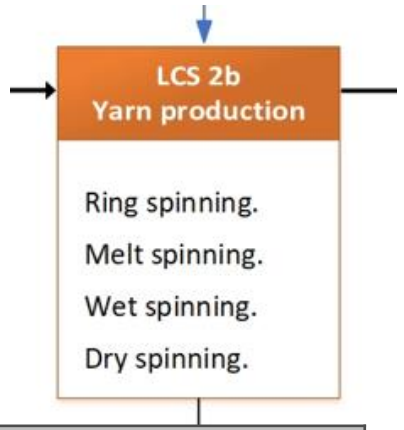
PRODUCTION PROCESS (LCS 2a Fibre pre-treatment)



Life Cycle inventory for the scouring process to be applied to the wool fibres pre-treatment; input data are quantified for 1 kg of fibres entering the process.

Fibre pre-treatment (Scouring)					
Name of LCI input/output requirement	**Unit**	**Value**	**Source/Assumption**	**Feedback OR new value**	**Additional comment**
Process losses	%	15	PEFCR Apparel&Footwear v1.2		
Thermal Energy	MJ/kg	2.37E+01	(Roth et al., 2023)		
Water	m3/kg	2.20E-02	(Roth et al., 2023)		
Wastes	kg/kg	6.80E-03	(Roth et al., 2023)		
Detergent	g/kg	1.02E+01	(Roth et al., 2023)		
Alkylphenol exthoxylates (APEOs)/ Nonylphenol ethoxylates (NPEOs) (in case these exist in locations outside the EU, where less restrictive "REACH-like" legislations might apply)	g/kg		(Roth et al., 2023). With specific regard to textile sector, under REACH (Annex XVII entry 46), NPEOs are restricted in textile and leather processing, except when there is no release in waste water. NPEOs are also restricted in textile products that are expected to be washed in water (Annex XVII 46a).		
Incidence of energy consumption for infrastructure management, compared to direct energy consumption for production unit processes	%	3.00E+01	Statistical value (energy consumption for infrastructure management / direct energy consumption for production) based on data reported by (Ozturk, 2005)		
Machine economic value (CAPEX)	€/unit	4.21E+03	Market prices from web: https://www.alibaba.com/product-detail/Large-size-industrial-washing-machine-wool_62119056754.html?spm=a2700.details.you_may_like.2.55002aa4blJJ4V [Accessed Sept 2024]		
Machine average lifetime (useful life)	years				
Average process duration	hr/kg				
Employment	FTE/kg[(a)]				

PRODUCTION PROCESS (LCS 2b Yarn production)

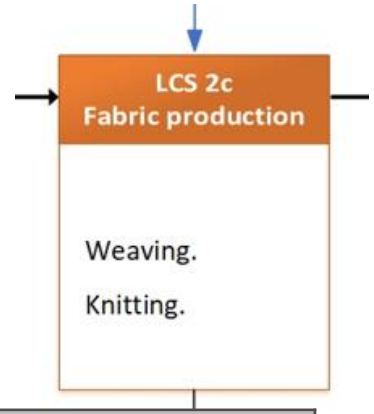


Life Cycle inventory for the ring spinning process; input data are quantified for 1 kg of fibres entering the process.

Ring spinning					
Name of LCI input/output requirement	**Unit**	**Value**	**Source/Assumption**	**Feedback OR new value**	**Additional comment**
Thermal Energy	MJ/kg	2.89E+00	Own elaboration based on various references (including EF3.1 and Ecoinvent database)		
Electricity Energy	kWh/kg	2.90E+00	Own elaboration based on various references (including EF3.1 and Ecoinvent database)		
Water	m3/kg	8.33E-05	Own elaboration based on various references (including EF3.1 and Ecoinvent database)		
Lubricating oil	kg/kg	1.44E-04	Own elaboration based on various references (including EF3.1 and Ecoinvent database)		
Waste lubricant	kg/kg	1.44E-04	Own elaboration based on various references (including EF3.1 and Ecoinvent database)		
Average process duration	kg/hr	4.00E+02	Amount of yarn produced in 1 hr. From International Production Cost Comparison in 2014. Source: International Textile Manufacturing Federation		
Emission/Waste: Water [urban air close to ground]	m3/kg	8.33E-05	Own elaboration based on various references (including EF3.1 and Ecoinvent database)		
Emission/Waste: Particulates, > 10 um [non-urban air or from high stacks]	kg/kg	5.61E-03	Own elaboration based on various references (including EF3.1 and Ecoinvent database)		
Process losses	%	22.14	Own elaboration based on various references (including EF3.1 and Ecoinvent database)		
Incidence of energy consumption for infrastructure management, compared to direct energy consumption for production unit processes	%	30	Statistical value (energy consumption for infrastructure management/ direct energy consumption for production) based on data reported by (Ozturk, 2005)		
Machine economic value (CAPEX)	€/unit	7.31E+04	Market prices from web: https://qdtongda.en.made-in-china.com/product/sjWEFmPVCiha/China-High-Speed-Yarn-Spinning-Machine-with-Cotton-Yarn-Spinning-Machine-Ring-Frame.html https://www.alibaba.com/product-detail/TONGDA-FA538-Sewing-Thread-Ring-Spinning_62134389982.html?spm=a2700.shop_plgr.41413.7.73cc7121mBHmYR		
Machine average lifetime (useful life)	Years				
Employment	FTE/kg[(a)]				

Note: Similar boxes are available for Melt, Dry and Wet spinning

PRODUCTION PROCESS (LCS 2c Fabric production)

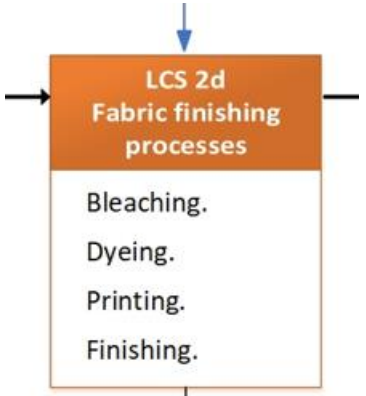


Life Cycle inventory for the weaving process; input data are quantified for 1 kg of yarn entering the process.

Weaving					
Name of LCI input/output requirement	**Unit**	**Value**	**Source/Assumption**	**Feedback OR new value**	**Additional comment**
Thermal Energy	MJ/kg	2.39E+00	Own elaboration based on various references (including EF3.1 and Ecoinvent database)		
Electricity Energy	kWh/kg	3.07E+00	Own elaboration based on various references (including EF3.1 and Ecoinvent database)		
Water	m3/kg	1.81E-03	Own elaboration based on various references (including EF3.1 and Ecoinvent database)		
Starch	kg/kg	3.86E-02	Own elaboration based on various references (including EF3.1 and Ecoinvent database)		
Polymethyl methacrylate, beads	kg/kg	8.31E-04	Own elaboration based on various references (including EF3.1 and Ecoinvent database)		
Rosin size	kg/kg	1.02E-02	Own elaboration based on various references (including EF3.1 and Ecoinvent database)		
Waste	kg/kg	4.62E-04	Own elaboration based on various references (including EF3.1 and Ecoinvent database)		
Wastewater	m3/kg	3.70E-06	Own elaboration based on various references (including EF3.1 and Ecoinvent database)		
Emission/Waste: Adsorbable organic halogen compounds (AOX) [Analytical measures to fresh water]	kg/kg	3.74E-06	Own elaboration based on various references (including EF3.1 and Ecoinvent database)		
Emission/Waste: Ammonium / ammonia [Inorganic emissions to fresh water]	kg/kg	4.95E-06	Own elaboration based on various references (including EF3.1 and Ecoinvent database)		
Other emission/waste					
Average process duration	min/kg	2.7	Time to process 1 kg of yarn. From International Production Cost Comparison in 2014. Source: International Textile Manufacturing Federation		
Process losses	%	3.87	Own elaboration based on various references (including EF3.1 and Ecoinvent database)		
Incidence of energy consumption for infrastructure management, compared to direct energy consumption for production unit processes	%	30	Statistical value (energy consumption for infrastructure management / direct energy consumption for production) based on data reported by (Ozturk, 2005)		
Machine economic value (CAPEX)	€/unit	3.05E+04	Market price from web: "https://qdtongda.en.made-in-china.com/product/GtHrPgWKHlcw/China-Tongda-Air-Jet-Loom-with-Beating-up-Mechanism-Air-Jet-Weaving-Machine-Price.html https://www.alibaba.com/product-detail/Most-Selling-Air-Jet-Loom-Machine_11000012815597.html?spm=a2700.7724857.0.0.2b7f4e2feip3GS		
Machine average lifetime (useful life)	years				
Employment	FTE/kg[(a)]				

Note: Similar box is available for knitting

PRODUCTION PROCESS (LCS 2d Fabric finishing processes)



Life Cycle inventory for the bleaching process; input data are quantified for 1 kg of fabric entering the process.

Bleaching					
Name of LCI input/output requirement	**Unit**	**Value**	**Source/Assumption**	**Feedback OR new value**	**Additional comment**
Thermal Energy	MJ/kg	1.62E-01	Own elaboration based on various references (including EF3.1 and Ecoinvent database)		
Electricity Energy	kWh/kg	4.27E-02	Own elaboration based on various references (including EF3.1 and Ecoinvent database)		
Water	m3/kg	6.10E-03	Own elaboration based on various references (including EF3.1 and Ecoinvent database)		
NaOH	kg/kg	9.00E-03	Own elaboration based on various references (including EF3.1 and Ecoinvent database)		
Hydrogen peroxide	kg/kg	3.00E-02	Own elaboration based on various references (including EF3.1 and Ecoinvent database)		
Complexing agent and stabiliser (organic)	kg/kg	3.45E-03	Data from BREF (Roth et al., 2023) and own elaboration		
Surfactant	kg/kg	1.45E-03	Data from BREF (Roth et al., 2023) and own elaboration		
Sodium silicate	kg/kg	2.67E-03	Data from BREF (Roth et al., 2023) and own elaboration		
Ammonia	kg/kg	2.42E-03	Data from BREF (Roth et al., 2023) and own elaboration		
Wastewater	m3/kg	6.10E-03	Own elaboration based on various references (including EF3.1 and Ecoinvent database)		
Process losses	%	1.8	Own elaboration based on various references (including EF3.1 and Ecoinvent database)		
Other Chemicals	kg/kg				
Incidence of energy consumption for infrastructure management, compared to direct energy consumption for production unit processes	%	30	Statistical value (energy consumption for infrastructure management / direct energy consumption for production) based on data reported by (Ozturk, 2005)		
Machine economic value (CAPEX)	€/unit	4.73E+04	Market prices from web: https://www.alibaba.com/product-detail/dying-and-bleaching-machine-for-fibers_1600845734576.html?spm=a2700.7724857.0.0.de0dThNFThNFnW https://www.alibaba.com/product-detail/medical-gauze-bleaching-machine-with-different_1600400426668.html?spm=a2700.7724857.0.0.de0dThNFThNFnW		
Machine average lifetime (useful life)	years				
Average process duration (hr/kg)	hr/kg				
Employment	FTE[(a)]				

Note: Similar boxes are available for Dyeing, Printing and Finishing

PRODUCTION PROCESS (LCS 2e Confectioning)

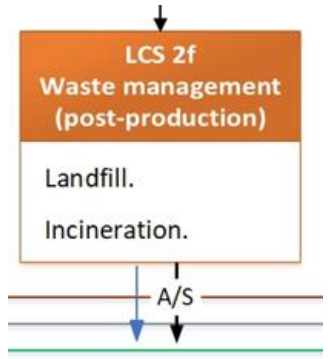
Life Cycle inventory for the confectioning process; input data are quantified for 1 kg of fabric entering the process.

Note: Similar box is available for knitting

WOVEN PRODUCT	Name of LCI input/output requirement	Unit	Value	Source/Assumption	Feedback OR new value	Additional comment
General CONFECTIONING	General finishing process losses	%	19.82	Data from EF3.1 database		
Pattern Design:	Average process duration (hr/kg)	hr/kg				
	Employment	FTE/kg[(a)]				
Spreading	Machine economic value (CAPEX) for Spreading	€/unit	19723	Market prices from web: "https://www.alibaba.com/product-detail/CNC-Polyester-spreading-machine-high-precision_1601044572114.html?spm=a2700.7724857.0.0.1ef9132aSqRWB6 [ACCESSED Sept 2024]		
	Machine average lifetime (useful life) for Spreading	years	15	Market price from web: https://www.oshima.com.tw/blog/how-to-extend-your-fabric-spreading-machine-lifespan		
	Electricity Energy	kWh/kg				
	Average process duration for Spreading (hr/kg)	hr/kg				
	Employment	FTE/kg[(a)]				
Cutting:	Machine economic value (CAPEX) for Cutting	€/unit	11676	Market prices from web: https://www.stylecnc.com/co2-laser-cutting-machine/large-format-fabric-laser-cutting-machine.html?srsltid=AfmBOoofRX-NC2N47JGOVot-4GRPlSmvkj2Ie-_5S_7Vn03ZDdA5WKOY		
	Machine average lifetime (useful life) for Cutting	years				
	Electricity Energy	kWh/kg				
	Average process duration for Cutting (hr/kg)	hr/kg				
	Employment	FTE/kg[(a)]				
Sewing:	Machine economic value (CAPEX) for Sewing	€/unit	4727	Market prices from web for industrial sewing machines: https://www.singeronline.com/simo20.html https://www.ae-sewingmachines.com/products/yamato-vc-2700g [ACCESSED Sept 2024]		
	Machine average lifetime (useful life) for Sewing	years				
	Electricity Energy	kWh/kg				
	Average process duration for Sewing (hr/kg)	hr/kg				
	Employment	FTE/kg[(a)]				
Finishing Processes (pressing, ironing, blocking and setting):	Machine economic value (CAPEX)	€/unit				
	Machine average lifetime (useful life)	years				
	Electricity Energy	kWh/kg				
	Average process duration for finishing (hr/kg)	hr/kg				
	Employment	FTE/kg[(a)]				

PRODUCTION PROCESS (LCS 2f Waste management – post-industrial)

Data gaps to implement post-industrial waste management model.

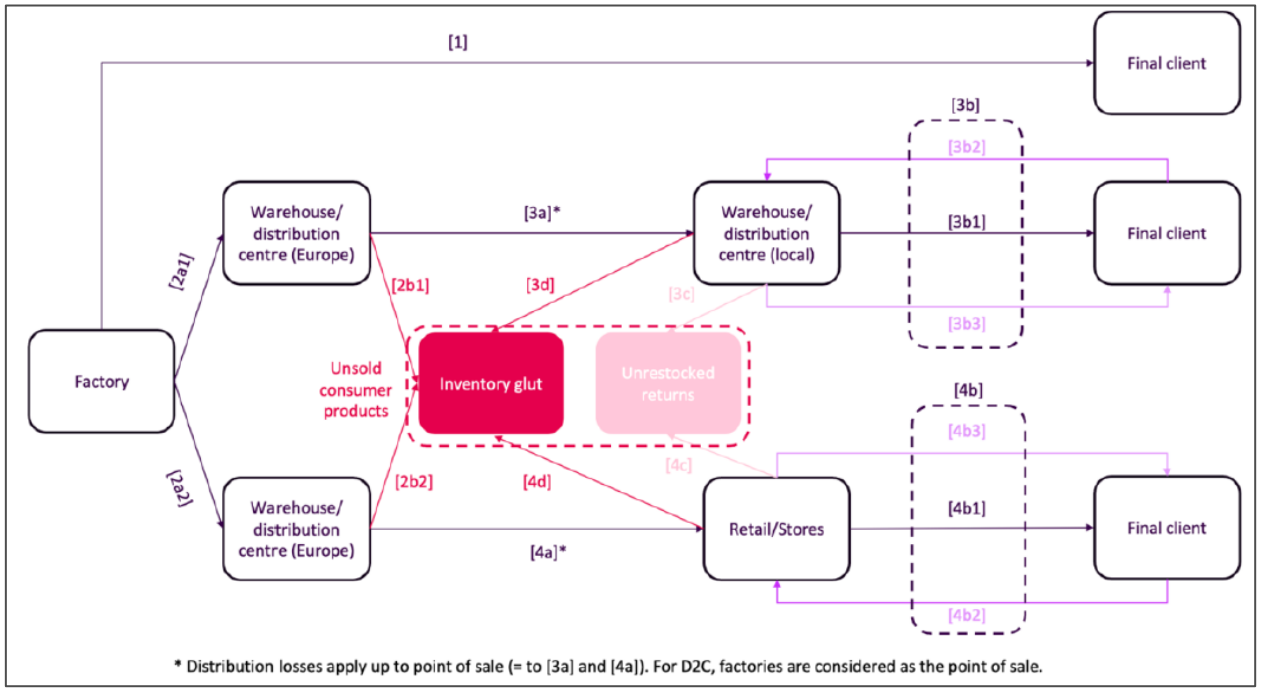


Production process	Waste management Shares	Value	Source/ Assumption	Feedback OR new value	Additional comment
Fibre pre-treatment	% recycling				
	% incineration				
	% landfill				
Yarn production	% recycling				
	% incineration				
	% landfill				
Fabric production	% recycling				
	% incineration				
	% landfill				
Fabric Finishing	% recycling				
	% incineration				
	% landfill				
Confectioning	% recycling				
	% incineration				
	% landfill				

Production process	Waste management Cost (€/kg)	Value	Source/ Assumption	Feedback OR new value	Additional comment
Fibre pre-treatment	Unit cost for recycling				
	Unit cost for incineration				
	Unit cost for landfill				
Yarn production	Unit cost for recycling				
	Unit cost for incineration				
	Unit cost for landfill				
Fabric production	Unit cost for recycling				
	Unit cost for incineration				
	Unit cost for landfill				
Fabric Finishing	Unit cost for recycling				
	Unit cost for incineration				
	Unit cost for landfill				
Confectioning	Unit cost for recycling				
	Unit cost for incineration				
	Unit cost for landfill				

RETAILING (LCS 3)

The ‘Retailing’ LCS3 includes the distribution of the products, the storage and the management of the waste resulting during these and the unsold products.



Source: PEFCR Apparel & Footwear v2.0

Shares of pre-consumer wasted garments routes.

Waste management of pre-consumer waste				
Shares of pre-consumer wasted garments routes		**Source/ Assumption**	**Feedback OR new value**	**Additional comment**
Landfill	55%	Based on Huygens et al., 2023		
Incineration	45%	Based on Huygens et al., 2023		
Recycling - total	0%	Based on Huygens et al., 2023		

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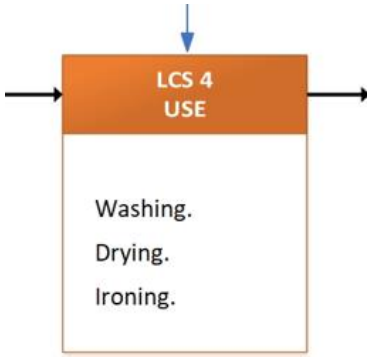
USE (LCS 4)



Reference conditions for the use of products belonging to categories identified in Task 4

Please provide data for the cells highlighted in orange (referring to 'number of uses' and 'number of washes') in the sheet “LCS4 Use” in the excel document provided.

Parameters related to garment use				
Number of uses (expressed in days of wear)		**Source/Assumption**	**Feedback OR new value**	**Additional comment**
Trousers, shorts and skirts excluding denim				
Denim trousers, shorts and skirts				
Sweaters, mid-layers and knitted dresses				
T-shirts and polo				
Shirts				
Blouses and woven dresses				
Jackets and coats				
Hosiery: leggings, stockings, tights and socks				
Underwear: underpants and boxers				
Swimwear				
Accessories				
Average number of uses prior to washing (expressed in days of wear)			**Feedback OR new value**	**Additional comment**
Trousers, shorts and skirts excluding denim				
Denim trousers, shorts and skirts				
Sweaters, mid-layers and knitted dresses				
T-shirts and polo				
Shirts				
Blouses and woven dresses				
Jackets and coats				
Hosiery: leggings, stockings, tights and socks				
Underwear: underpants and boxers				
Swimwear				
Accessories				

End of Life (LCS 5)

Modelling will be done based on the EF Circular Footprint Formula (CFF):

Material

$$(1 - R_1)E_V + R_1 \times \left(A \times E_{recycled} + (1 - A)E_V \times \frac{Q_{Sin}}{Q_p}\right) + (1 - A)R_2 \times \left(E_{recyclingEoL} - E_V^* \times \frac{Q_{Sout}}{Q_P}\right)$$

Energy

$$(1 - B)R_3 \times (E_{ER} - LHV \times X_{ER,heat} \times E_{SE,heat} - LHV \times X_{ER,elec} \times E_{SE,elec})$$

Disposal

$$(1 - R_2 - R_3)E_D$$

R1 Recycled content = 0%
R2 Material for recycling = 0%
R3 Material for disposal = 55%

Shares of post-consumer wasted garments routes		Source/Assumption
Landfill	55%	Based on Huygens et al., 2023
Incineration	45%	
Recycling - total	0%	

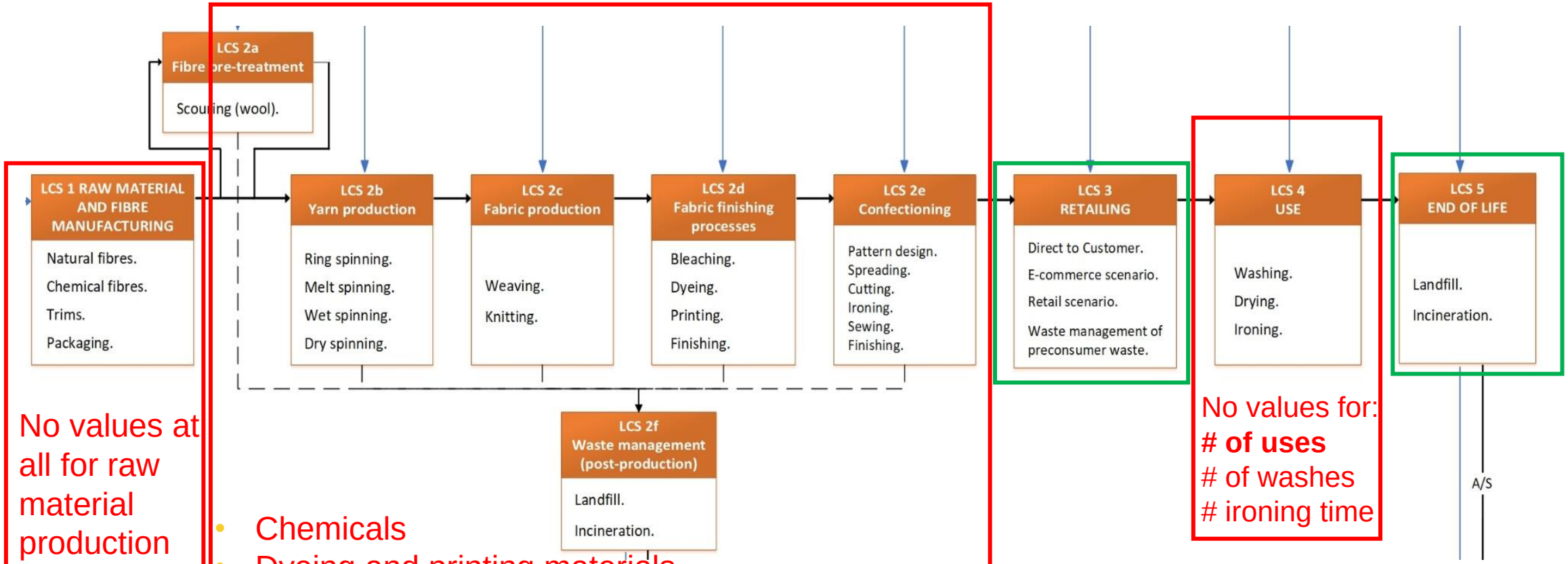
Transport (LCS 1 and LCS 2)

The model implemented to represent the transport that occurs along the supply chain includes: the transport of raw materials and intermediates on a global scale

Geographical breakdown of global apparel production and consumption (Source Figure 4 of 1st milestone of the PS)														
PROCESS	**Bangladesh**	**Brazil**	**China**	**EU (27+1)**	**India**	**Indonesia**	**Pakistan**	**Russia**	**Turkey**	**USA**	**Vietnam**	**Other**	**Feedback OR new value**	**Additional comment**
Fiber production	N.A.	1%	57%	7%	13%	2%	N.A.	1%		4%	N.A.	15%		
Yarn production	3%	N.A.	64%	1%	9%	N.A.	4%	N.A.		N.A.	N.A.	19.00%		
Fabric production	3%	1%	60%	N.A.	12%	N.A.	2%	N.A.	5%	N.A.	N.A.	17.00%		
Dyeing & Finishing	28%	N.A.	44%	11%		N.A.	N.A.	N.A.	17%	N.A.	N.A.	0.00%		
Assembly	7%	N.A.	35%	11%	7%	N.A.	N.A.	N.A.	N.A.	N.A.	6%	34.00%		

Global production in tonnes of the textile sector, breakdown for manufacturing phases.				
PROCESS	**Global production 2018 (tonnes)**	**Source**	**Feedback OR new value**	**Additional comment**
Fiber production	107,000,000	https://textileexchange.org/news/2019-preferred-fiber-materials-report/		
Yarn production	97,833,092	https://textileexchange.org/app/uploads/2022/08/Fiber-Conversion-Methodology-2022.pdf		
Fabric production	86,693,816	https://textileexchange.org/app/uploads/2022/08/Fiber-Conversion-Methodology-2022.pdf		
Dyeing & Finishing	79,394,197	Calculation based on the amount reported in the previous step integrating data on process losses From EF3.1 database (losses = 8.42%)		
Assembly	63,658,267	Calculation based on the amount reported in the previous step integrating data on process losses From EF3.1 database (losses = 19.82%)		

Main value gaps summary



No values at all for raw material production

- Chemicals
- Dyeing and printing materials
- Machine average lifetime
- Average process duration and Employment
- Unit costs and % of recycling, incineration & landfill

No values for:
# of uses
# of washes
ironing time

Next steps

The Excel template:

Fibre pre-treatment (Scouring)					
Name of LCI input/output requirement	Unit	Value	Source/Assumption	Feedback OR new value	Additional comment
Process losses	%	15	PEFCR Apparel&Footwear v1.2		
Thermal Energy	MJ/kg	2.37E+01	(Roth et al., 2023)	OK	It would be better to use kWh/kg instead of MJ
Water	m3/kg	2.20E-02	(Roth et al., 2023)	0.018	This value should be less than 20 kg/kg. Best estimate would be 18
Wastes	kg/kg	6.80E-03	(Roth et al., 2023)	OK	
Detergent	g/kg	1.02E+01	(Roth et al., 2023)	9.9	
Alkylphenol exthoxylates (APEOs)/ Nonylphenol ethoxylates (NPEOs)	g/kg		(Roth et al., 2023). With specific regard to textile sector, under REACH (Annex XVII entry 46), NPEOs are restricted in textile and leather processing, except when there is no release in waste water. NPEOs are also restricted in textile products that are expected to be washed in water (Annex XVII 46a).	0.025	It is difficult to estimate but based on 'X' it is stated that the content of APEOs in case 'Y' was 0.025 g/kg

40

Data in **white cells** refer to data we consider of **higher quality**

Data in **yellow cells** are data where **validation by stakeholders** is welcome

Missing data in **orange cells** are **gaps** (for which **inputs from stakeholders are needed**)

- **Document in Excel format (direct feedback) and Document in PDF format (supporting the Excel)**
- **Comments and indications on model features and assumptions will be collected ONLY through the spreadsheet Excel document by using the sheet labelled "Comment and Feedback".**
- The spreadsheet Excel document with your comments and indications should be sent to JRC-B5-TEXTILES@ec.europa.eu by the **end of business on 24th of February 2025**

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Questions ?

- **What could be the number of uses for each product category?**
- **Would it be possible to get data for the LCC parameters (Machine average lifetime, Average process duration, Employment)?**
- **Is it possible to get data for the chemicals especially in dyeing and printing?**
- **Is there information about the unit costs and shares % of recycling, incineration & landfill?**
- **Is it possible to find data for the production of raw materials (e.g. cotton, polyester etc)?**

Closing remarks

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Thank you

JRC-B5-TEXTILES@ec.europa.eu

Slide 31: Retailing figure, source: PEFCR Apparel and Footwear v2.0

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