LCSA for Decision Making in Humanitarian Operations : Insights from the Bio4HUMAN Project

Carolina SZABLEWSKI
With Emilie GUILVERT, Perrine SEBASTIEN, Carla BARTOLOMÉ, Andrea RODENAS, Clara CASADO, Marta RUMAYOR

11/09/2025 – Palermo

Funded by the European Union

LCM 2025

weloop

BIO4HUMAN

Funded by the European Union

Office of expertise and innovation in Life Cycle Assessment

Our services and expertise

Sustainability measures based on life-cycle approaches

Support for eco-design and innovation

Criticality assessment of metals and minerals

Development of Life Cycle Inventories

Research & Development

Trainings and awareness-raising

Development of digital tools

Our sectors

Energy

Batteries

Mobility

Electric
Electronic

Building
Civil engineering

Agrifood
Agriculture

LCM 2025

BIO4HUMAN

Funded by the European Union

Content

Bio4HUMAN EU Project

Identifying bio-based solutions for waste management applicable to humanitarian sector

01/01/2024 – 30/06/2026

9 Work packages, WP5 = E-LCA, WP6 = LCC and S-LCA

Goal = Reduce Waste in Humanitarian Aid Sector using bio-based solutions

5 Waste generative sectors

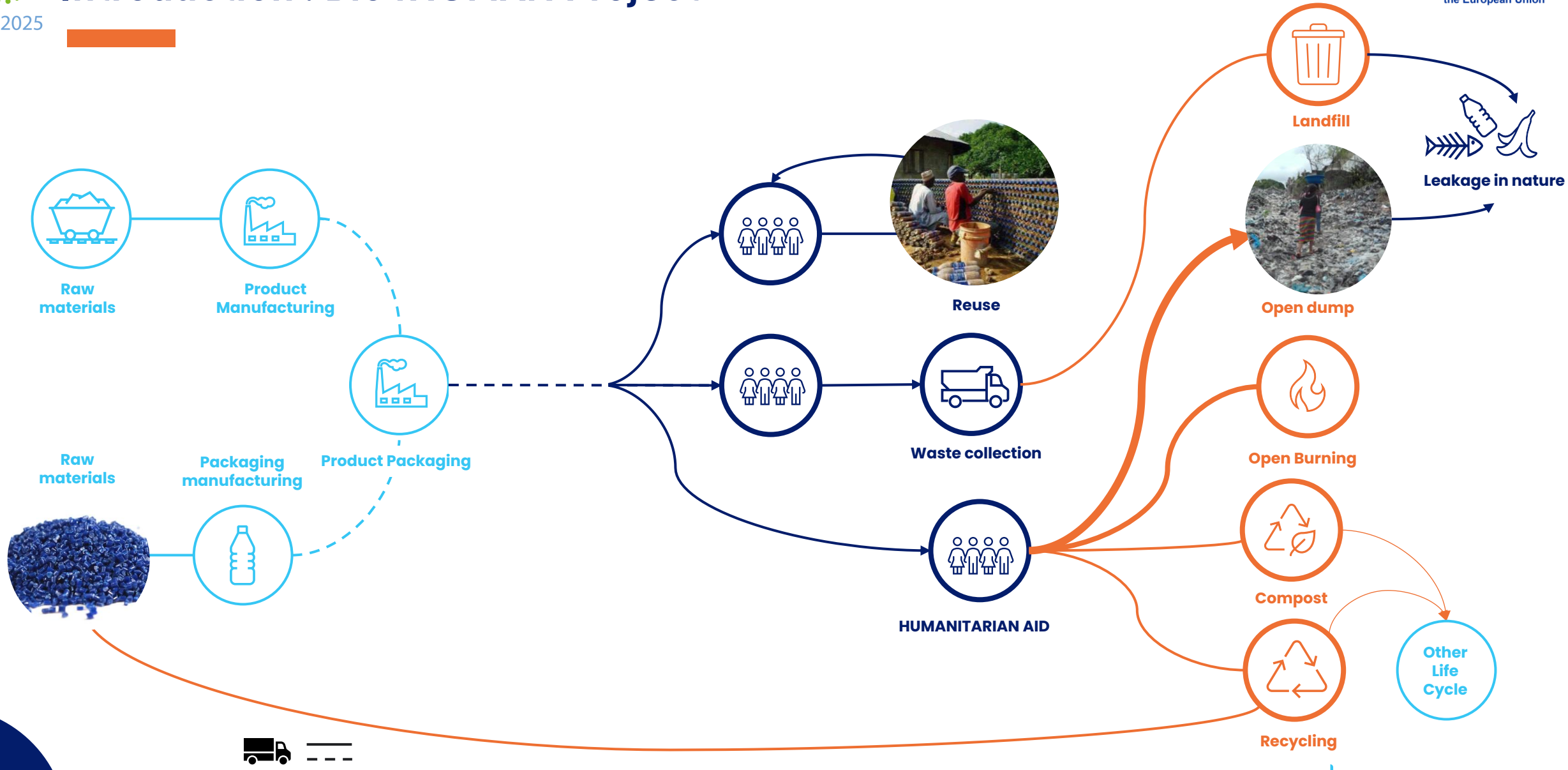
- Food and Nutrition
- Agriculture
- Non-Food Items
- Water, Sanitation and Hygiene (WASH)
- Construction

Case Studies in **2 Countries**

South Sudan

DRC

Introduction : Bio4HUMAN Project



E-LCA : WASH Kit Presentation with Indicators

LCM 2025

BIO4HUMAN

Funded by the European Union

WASH Kit

References : UNICEF, Oxfam, UNFPA, Joint Initiative

Item	quantities for 1 family for 1 month
Water container without logo (3)	2
Bucket with lid (3)	1
Soap toilet bar wrapped (2)	12
Water purification tablets (50 tablets /unit) (2)	6
Torch handheld self powered (2)	1
Child potty	1
Multipurpose cloth (1)	2
Reusable menstrual pads set (1)	2
Female disposable sanitary pads with wings (1)	2
Whistle (3)	1
Female underwears set (1)	1
Laundry detergent (3)	1
Guidance on kit use (1)	1

PLA bottle for water and oil

Organic Sanitary pads

Item	Primary packaging	Secondary packaging	Tertiary Packaging
(1)	PE bag	Carboard + Tape	
(2)	Cardboard	Carboard + Tape	PE film and Wooden EURO pallet (EUR1)
(3)	/	Cardboard + Tape	

PLA Film

Biodegradable Tape

Indicators EF 3.1

Climate Change → Critical due to increased droughts, floods, food insecurity

Eco-toxicity freshwater → Key in zones where waste contaminates water

Eutrophication freshwater → Often caused by poorly treated waste and fertilizers

Land Use → Biobased products affects ecosystems or food availability

Ressource use fossils → different mixes for 2 countries, to see the energy demand and fossil raw materials

Water Use → Essential in water-scarce areas

Other indicators

Plastic effect on biota (Impact World +)

Toxic impact of plastic particles (especially **microplastics**) on living organisms in aquatic environments

→ Relevant for plastics end-of-life impacts in open dump and landfill

Biogenic Carbon Content (EN 15804+A2)

CO_2 absorbed and stored by biomass during growth credited as temporary carbon storage, reducing climate impact, **not accounted for in EF3.1**

→ Relevant for biobased products

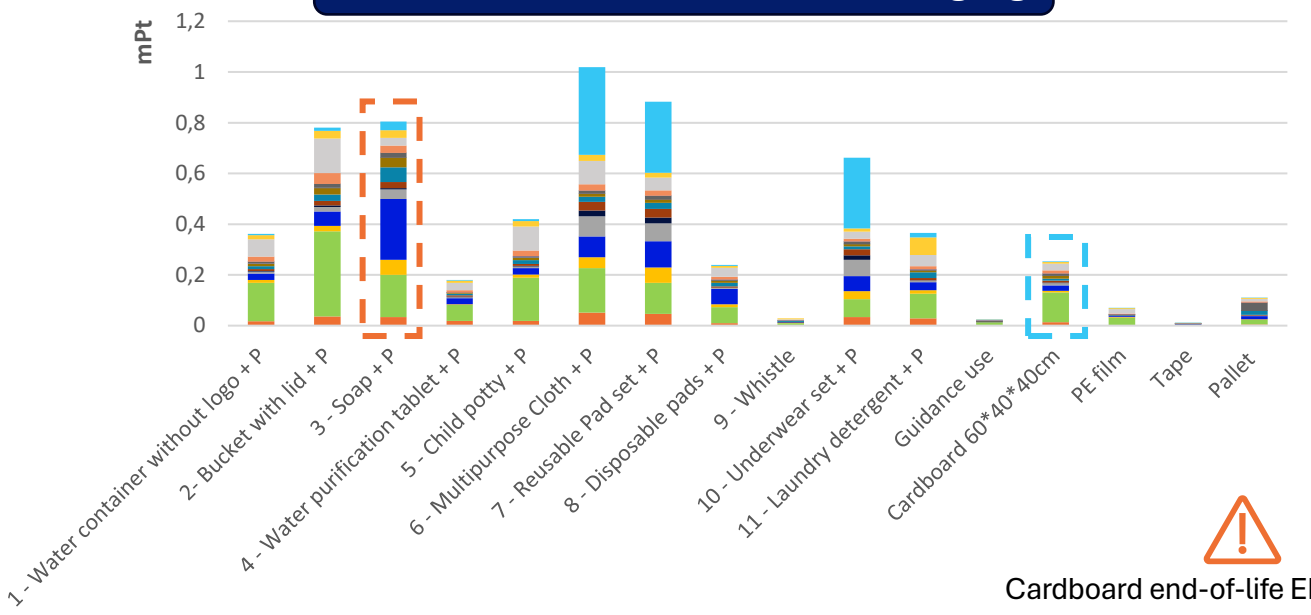
E-LCA : WASH Kit Analysis

LCM 2025

BIO4HUMAN

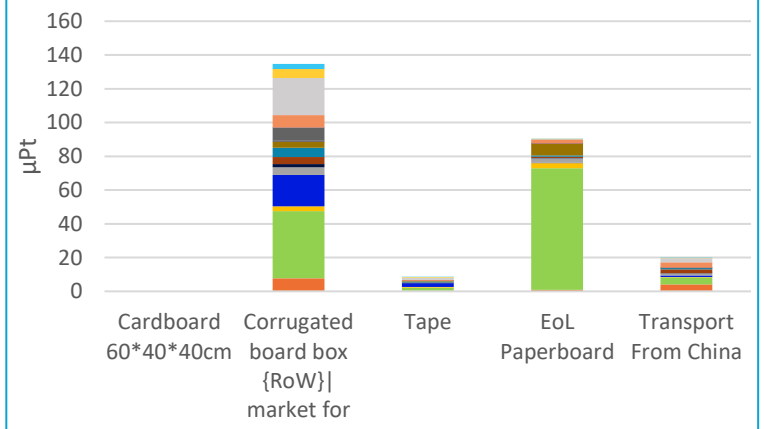
Funded by the European Union

Reference WASH Kit with Packaging



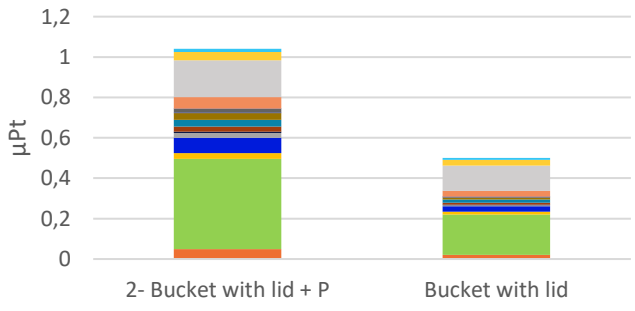
- Water use
- Resource use, minerals and metals
- Resource use, fossils
- Photochemical ozone formation
- Ozone depletion
- Land use
- Ionising radiation
- Human toxicity, non-cancer
- Human toxicity, cancer
- Eutrophication, terrestrial
- Eutrophication, freshwater
- Eutrophication, marine
- Particulate matter
- Ecotoxicity, freshwater
- Climate change
- Acidification

Cardboard



Cardboard end-of-life EI3.10 dataset adapted to Europe (Hg content)

Bucket with and without packaging



Packaging considered : **cardboard** and tape

Cardboard packaging **End-of-Life** in the studied countries

If **unbleached/no toxic prints**: **compostable**

➔ **Solution** to reduce EoL impacts:
end-of-life compost solutions ongoing assessment

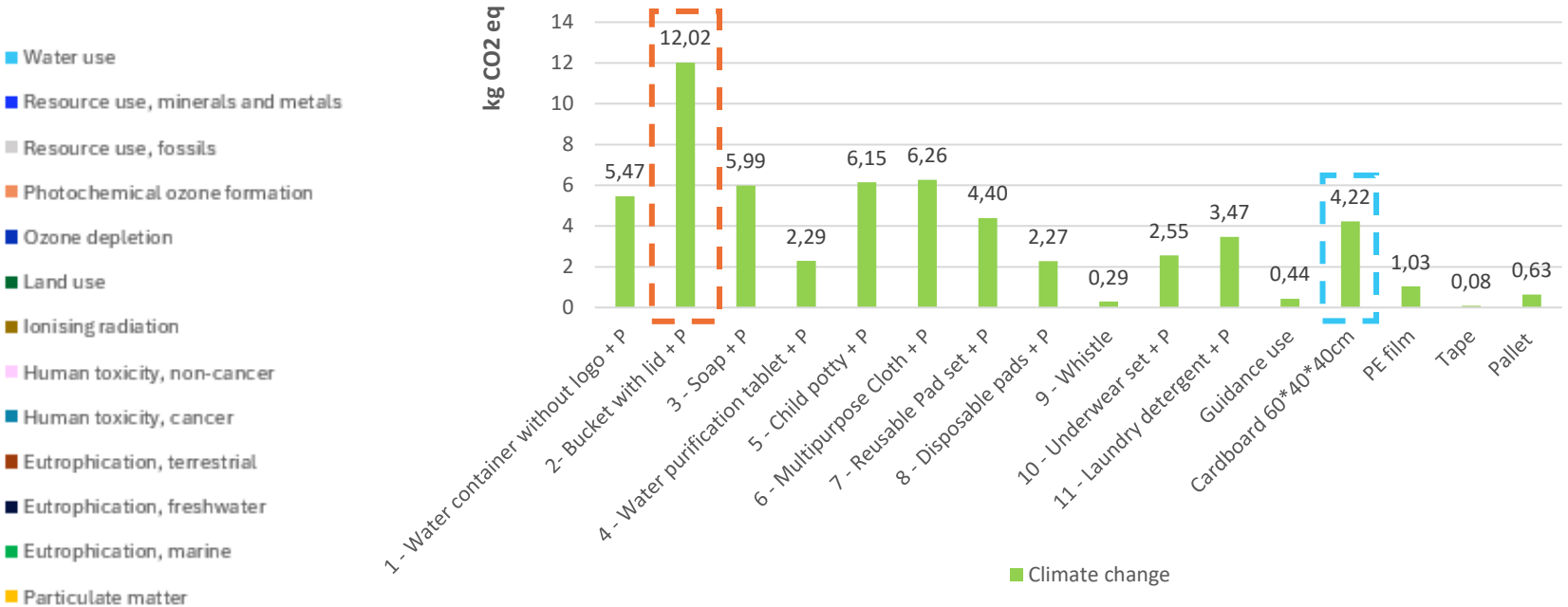
E-LCA : WASH Kit Analysis

LCM 2025

BIO4HUMAN

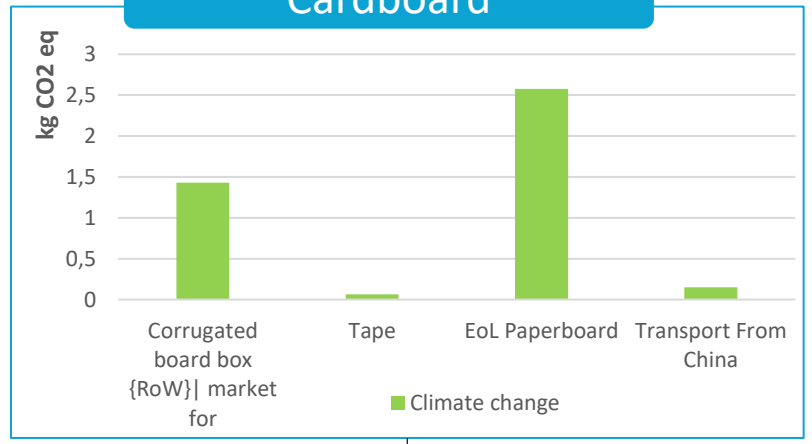
Funded by the European Union

Reference WASH Kit with Packaging

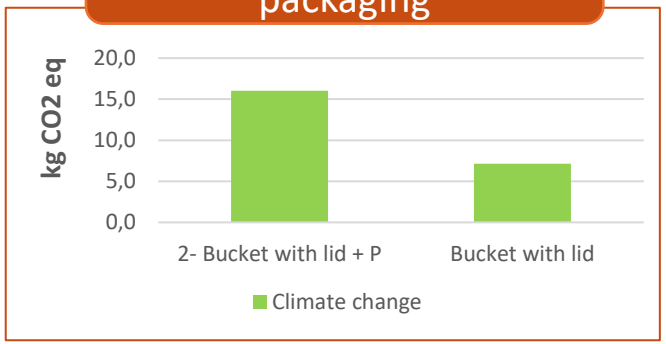


Climate change, total:
58 kg CO_2, eq
CDG → PMO trip ≈ 3 kits

Cardboard



Bucket with and without packaging



Packaging considered :
cardboard and tape

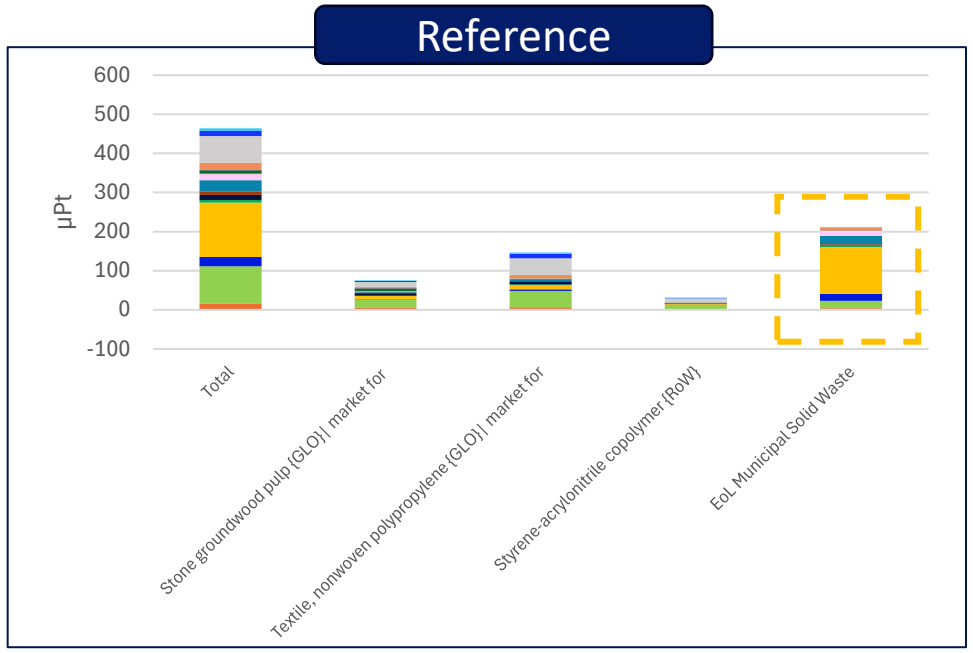
Cardboard packaging **End-of-Life** in the studied countries

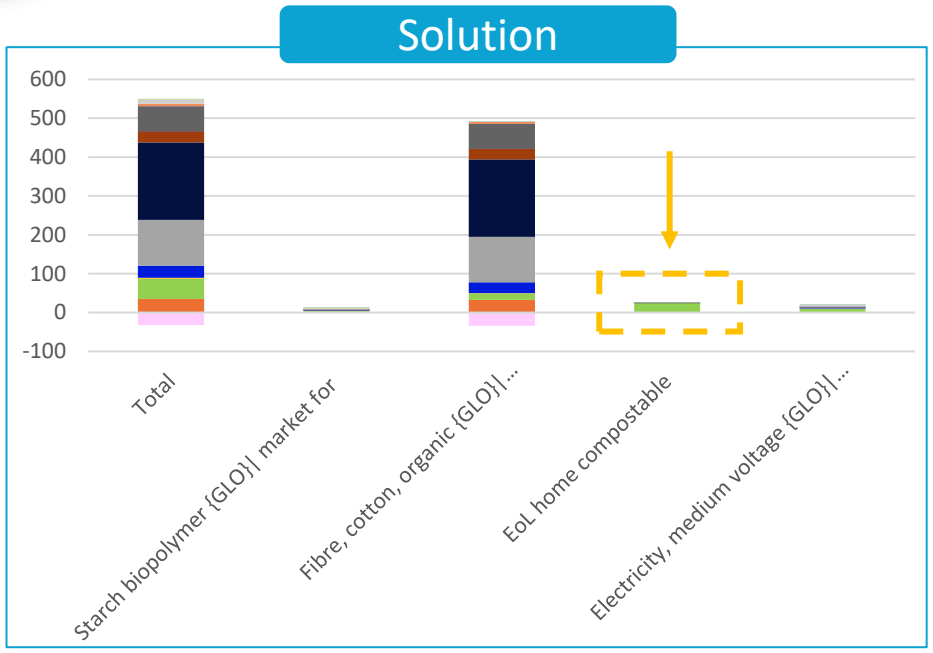
If **unbleached/no toxic prints**: **compostable**
➔ **Solution** to reduce EoL impacts:
end-of-life compost solutions ongoing assessment

E-LCA : WASH Kit

Results of sanitary pads

Diminution of End-of life impacts





3,64 PDF.m2year from PP textile microfibers

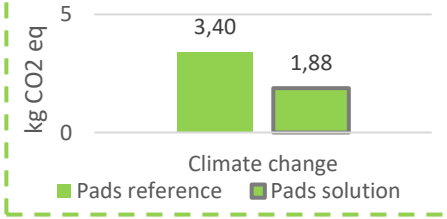
Production : - 0 kgCO2,b
End-of-life : + 0 kgCO2,b

0 PDF.m2year as starch bio compostable

Production : **- 1.70** kgCO2,b eq
End-of-life (home compost): **+ 0,92** kgCO2,b eq

Less microplastics pollution

Carbon temporary storage



With 20 pads of 0.01kg per kit
South Sudan : 77 000 kits in 2024 ➔ **around - 23,4 tCO2 eq**
DRC : 330 000 kits in 2024 ➔ **around – 100,3 tCO2 eq**

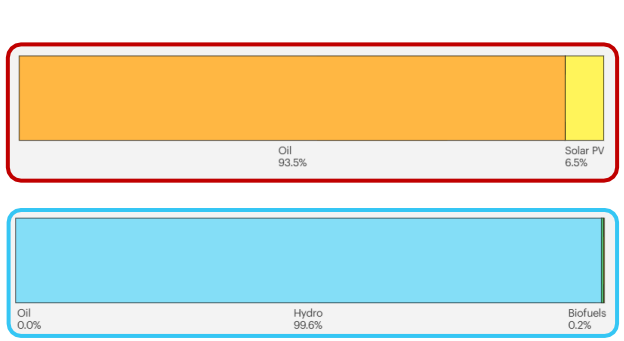
Geographical Assessment

LCM 2025

BIO4HUMAN

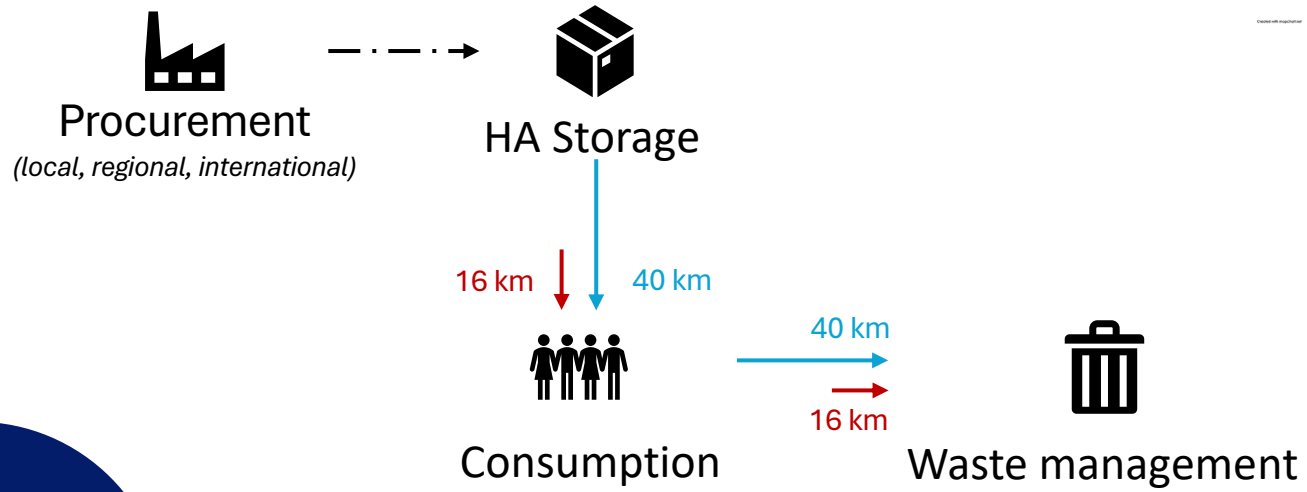
Funded by the European Union

LCIA results depend on regional **grid mix:**



Reference : IEA

LCIA results depend on **supply chain distances:**



Criticality

Bio-based material ← Intermediate flows — **Supply countries**

Supply must be stable and reliable for HA emergencies

Criticality indicators of interest for bio-based materials:

- Biotic resource depletion
- Land Use
- Water Depletion Index
- Food Security Index: avoid competition
- Economic Vulnerability Index: agriculture and agricultural instability, forestry and fisheries, export instability and concentration
- Raw material availability: biowastes are “by-products”
- Concentration of supply

Based on BIRD and IRTC methods *(with Calimero excel tool)*

Data availability

➔ qualitative assessment, mitigation measures

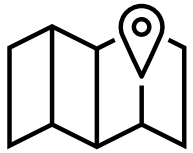
Life Cycle Costing (LCC)

Humanitarian Perspective

The LCC focuses on humanitarian organizations' needs, considering the specific constraints of crisis context limited resources, lack of waste treatment facilities, and high logistical costs.

Field constraints

(infrastructure, logistics, etc.)



Geographical variability

(sourcing, transport distances, etc.)

Time & cost presssure

Scope of LCC

- Support decision-making for sustainable procurement in humanitarian operations
- Perspective: **Humanitarian aid organizations**
- Flows considered: **Only negative cash flows**
- Externalities: **not included**
- Primary data:
  - Humanitarian Organizations
  - Suppliers generic data

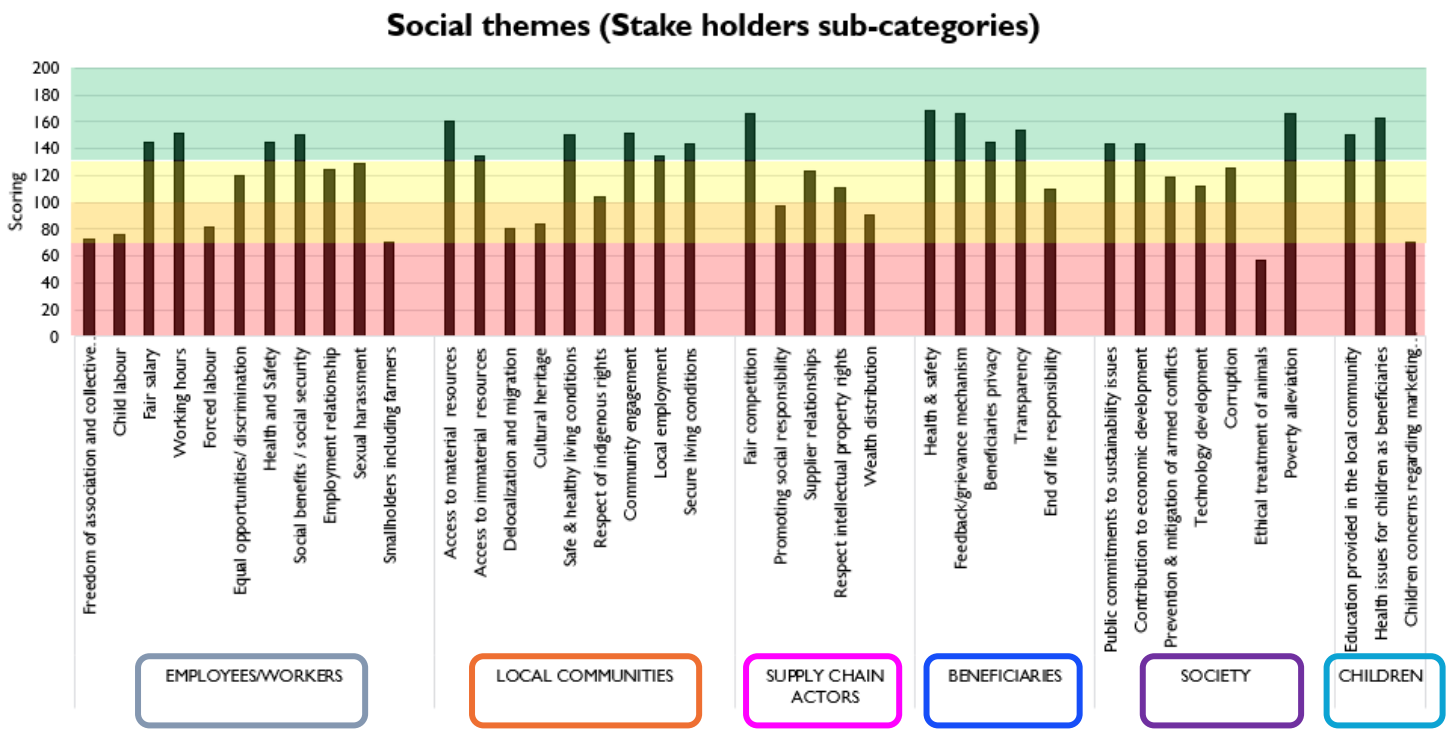
S-LCA Methodology

LCM 2025

BIO4HUMAN

Funded by the European Union

Surveys to actors



Although an important issue in Aid distribution practices, in this specific context it's made irrelevant

Stakeholder	Social themes	Target Aud.
BENEFICIARIES	Health & safety	SP+HO*
	Feedback/grievance mechanism	HO
	Transparency	HO+SP
	~~Beneficiaries' privacy~~	
CHILDREN	Health issues for children as beneficiaries	SP
	Education provided in the local community	HO+SP
EMPLOYEES WORKERS	Working hours	SP
	Social benefits / social security	SP
	Fair salary	SP
	Health and Safety	SP
LOCAL COMMUNITIES	Access to material resources	SP+HO?
	Community engagement and Delocalization	HO+SP
	Safe & healthy living conditions	SP+HO
	~~Secure living conditions~~	
	Local employment	SP
	Access to immaterial resources	SP+HO
SOCIETY	Poverty alleviation	SP
	Public commitments to sustainability issues	SP
	Contribution to economic development	SP+HO
SUPPLY CHAIN ACTORS	Fair competition	HO

** SP: Solution Provider*
HO: Humanitarian Organization

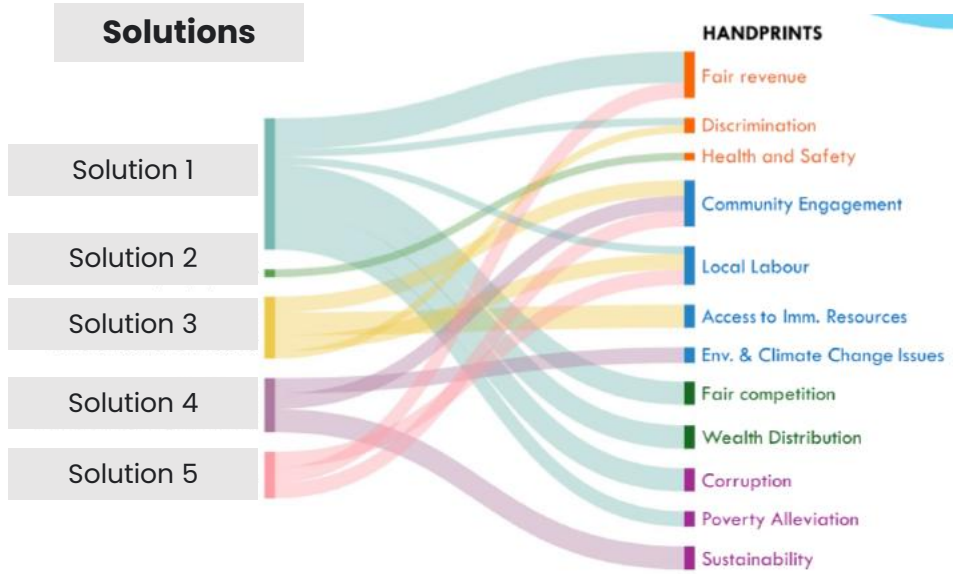
Highly crucial issue for low developed regions, that is often not considered by solution providers

S-LCA Results presentations

Social impacts matrix of solutions

Handprint Footprint

	Health & safety	Working hours	Local labour	Environmental & climate issues	Corruption
Solution 1					
Solution 2					
Solution 3					
Solution 4					
…					
Solution 10					



Example of answers segmentations

Committed Conduct | 4	Continual improvement is mainstream in the company / product design
Proactive Conduct | 3	Initiatives remain at the individual level or occur as isolated events
Legal Conduct | 2	The minimum legal requirements are respected
Risk Conduct | 1	The minimum legal requirements are not respected
No information | N/A	The supplied information is insufficiant for a clear assessment

Conclusions

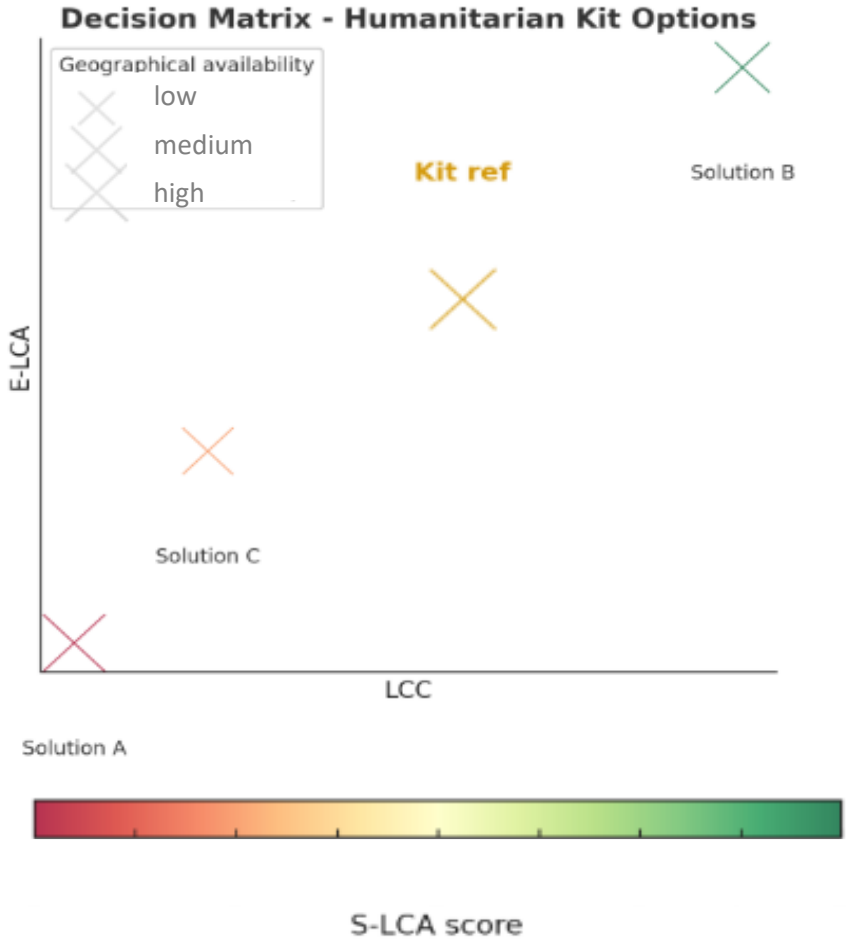
Bio4HUMAN – Integrated LCSA for more sustainable humanitarian choices

Humanitarian camps: **product end-of-life** is a critical **hotspot**.

Bio-based solutions **do not always deliver a global E-LCA gain** but significantly **reduce local impacts**.

Decision matrix = combining E-LCA, LCC, S-LCA, and geographical assessment for fit-for-purpose choices.

*Beyond global averages, making choices where they matter most: **in the field***



BIO4HUMAN

Funded by the European Union

weloop

Thank you !

c.szablewski@weloop.org

WeLOOP
254 Rue du Bourg,
59130 Lambersart
09 81 85 76 82

www.weloop.org

Follow us on LinkedIn

LCM 2025