



# Lessons learned from Life Cycle Assessment applied to previous ESA missions

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# Case study: LCA comparison

## Preliminary Life Cycle Assessment comparison of three ESA Earth observation missions

### Objectives:

- Identify potential trends and discrepancies in the environmental impacts of the missions;
- Identify LCA methodological trends and discrepancies among the different projects;
- Give recommendation for future LCA comparisons.







**Functional unit:** "The manufacturing, integration, qualification, testing and preparation for launch of the space segment to fulfil its requirements".





**Reference flow:** one Protoflight model (PFM) and one Flight model 2 (FM2).

**System boundaries:** space segment, phases B2, C/D and E1. Excluded launch and ground segment, Ground support equipment and instruments of payload.



# Case study: LCA comparison

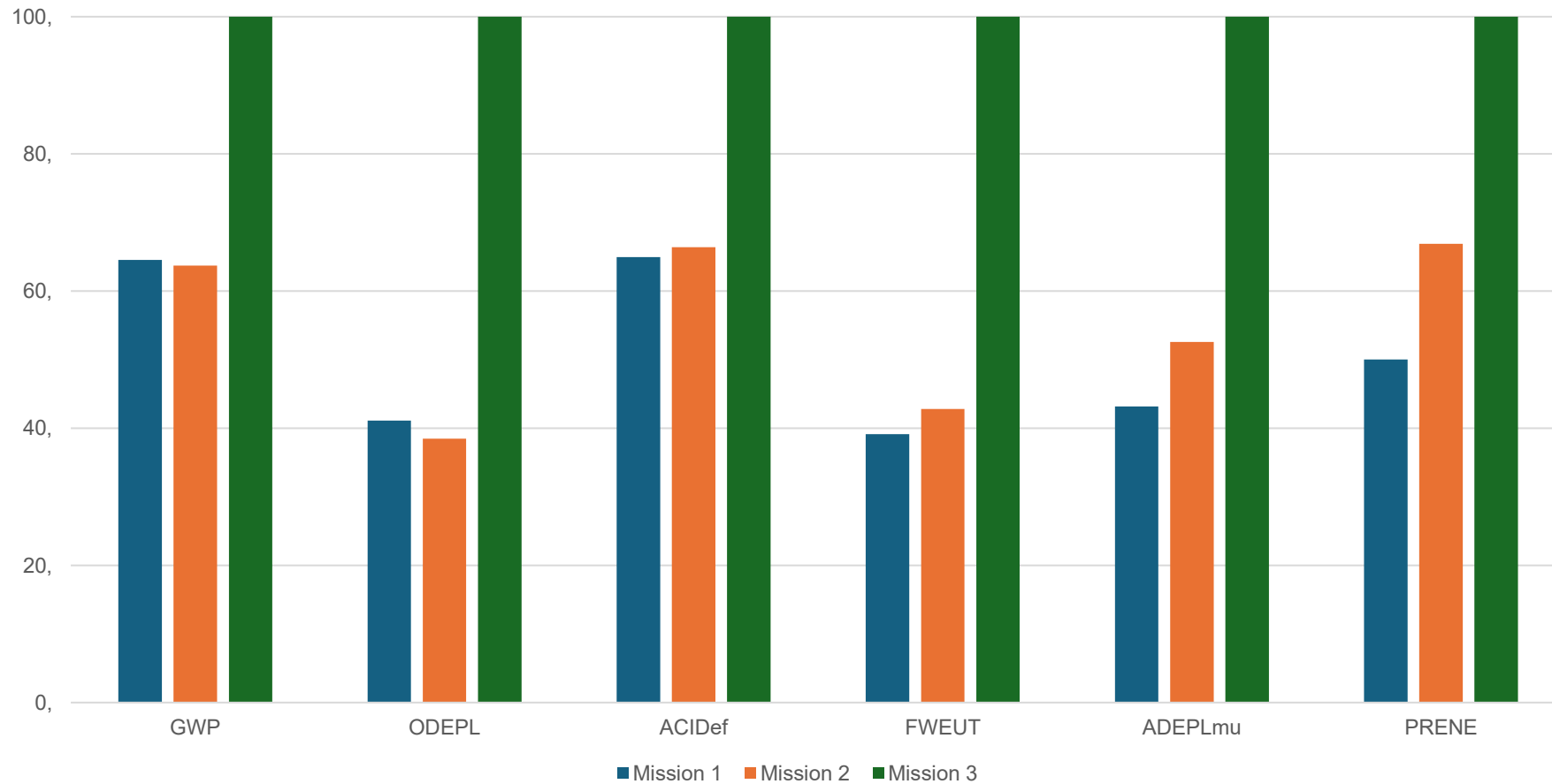
 <p><b>Climate change</b></p>	 <p><b>Ozone depletion</b></p>	 <p><b>Air acidification</b></p>
 <p><b>Freshwater eutrophication</b></p>	 <p><b>Abiotic resource depletion of minerals</b></p>	 <p><b>Primary energy consumption</b></p>

Staff	Dry mass	Test	Cleanroom	Transport
		TVAC, mechanical, acoustic		



# Case study: LCA comparison

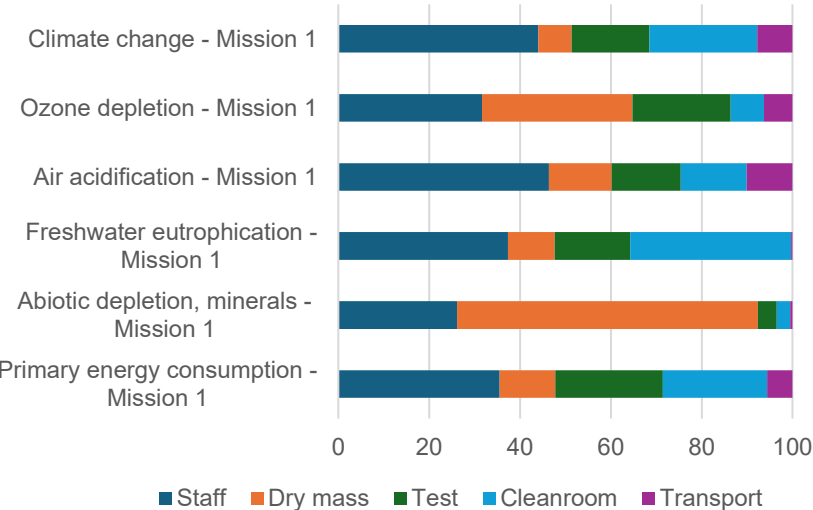
Environmental impact assessment of three ESA Earth observation missions



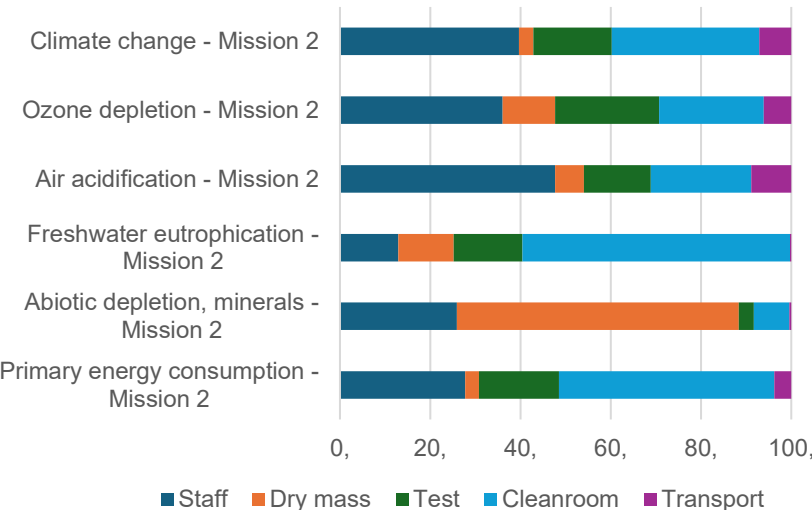


# Case study: LCA comparison

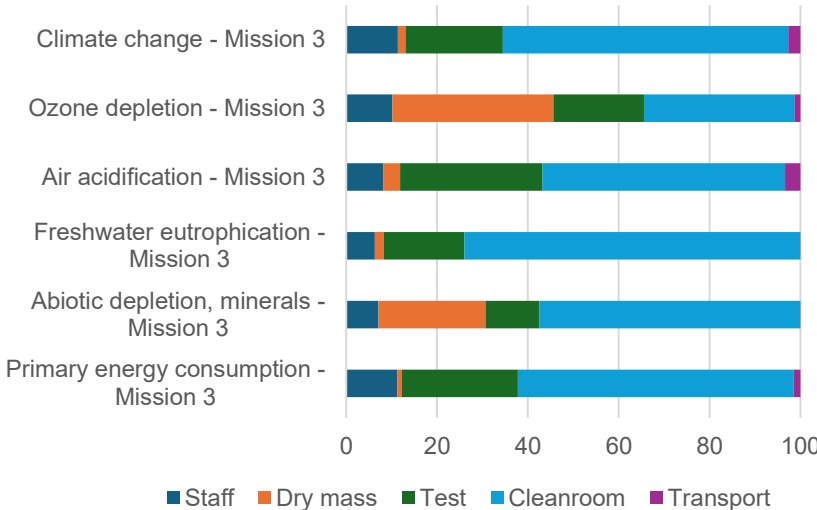
Breakdown of relative impacts of Mission 1



Breakdown of relative impacts of Mission 2



Breakdown of relative impacts of Mission 3



Electricity used in AIT for PFM and FM2

Travels of staff, electricity for office work

Nitrogen for TVAC test, electricity

Transport negligible

Gold for electronic parts of computers (1,2) - ADEPL

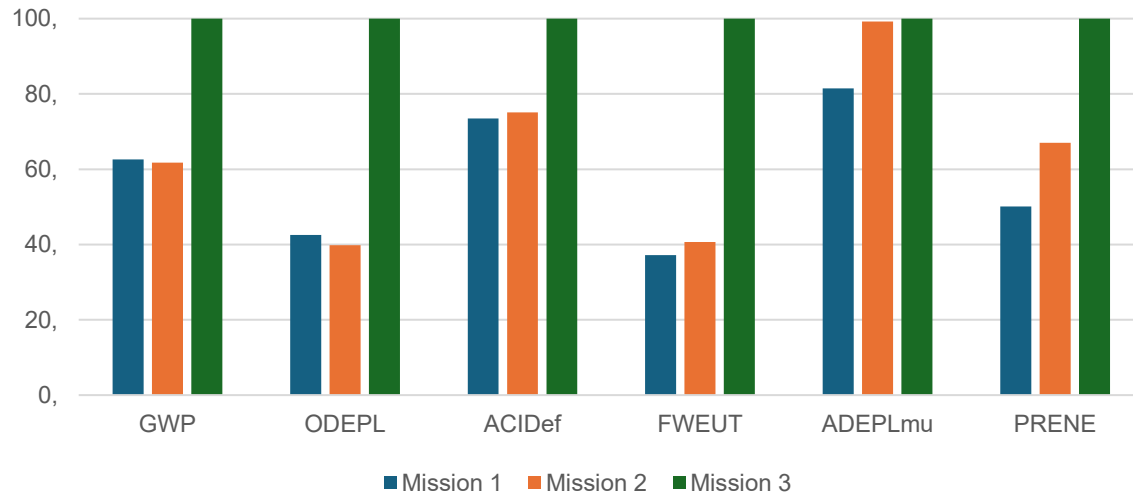
Gold for circuits - ADEPL

Copper – distribution network for low voltage (3) - ADEPL

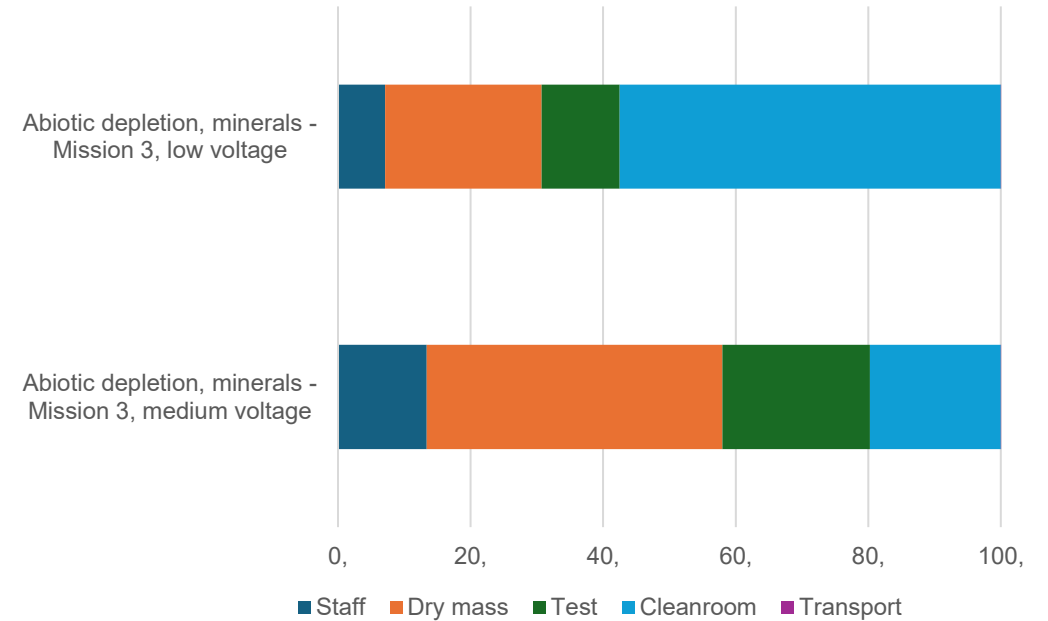


# Sensitivity analysis of Mission 3

Environmental impact assessment of three ESA Earth observation missions, after a sensitivity analysis on the voltage type for electricity datasets.



Breakdown of the relative impacts on Abiotic depletion, minerals, before and after sensitivity analysis. Results for Mission 3.





# Lessons learned from the comparison

## Methodology

Systematic approach to clean room allocation

Only a subset of **tests** are included, lack of manufacturing processes → improvement with R&D activities on **MAIT** / exploit already available datasets

Use of electricity with low voltage creates hotspot in **ADEPLmu** more than medium voltage one

Assessment at equipment level has poor data quality → results on dry mass might change

## Results oriented

Testing activities, including electricity consumption of clean room, are identified as main contributor

Staff activities follow as second most impacting

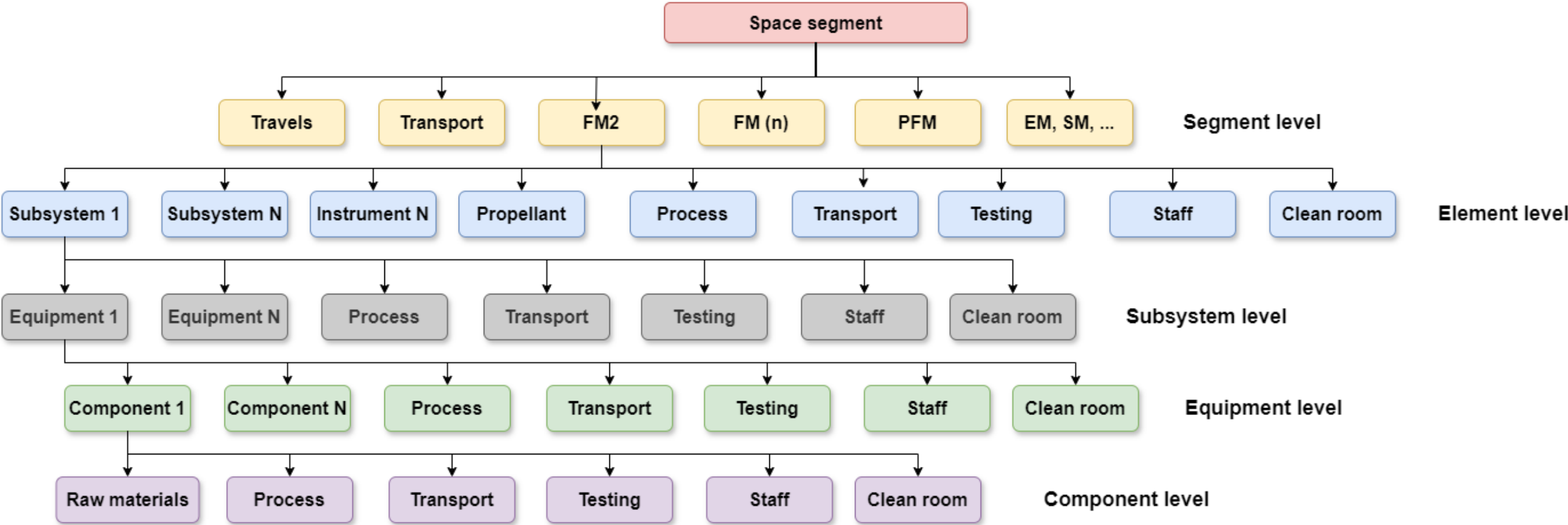
**ADEPLmu** driven by dry mass, contribution coming from gold utilized in EEE components

**Transport** negligible, majority comes from transport of PFM and FM2 to launch site in French Guyana

**Number of travel** for staff discrepancies → different order of magnitude in number of travels influences impact in Global Warming Potential (GWP)



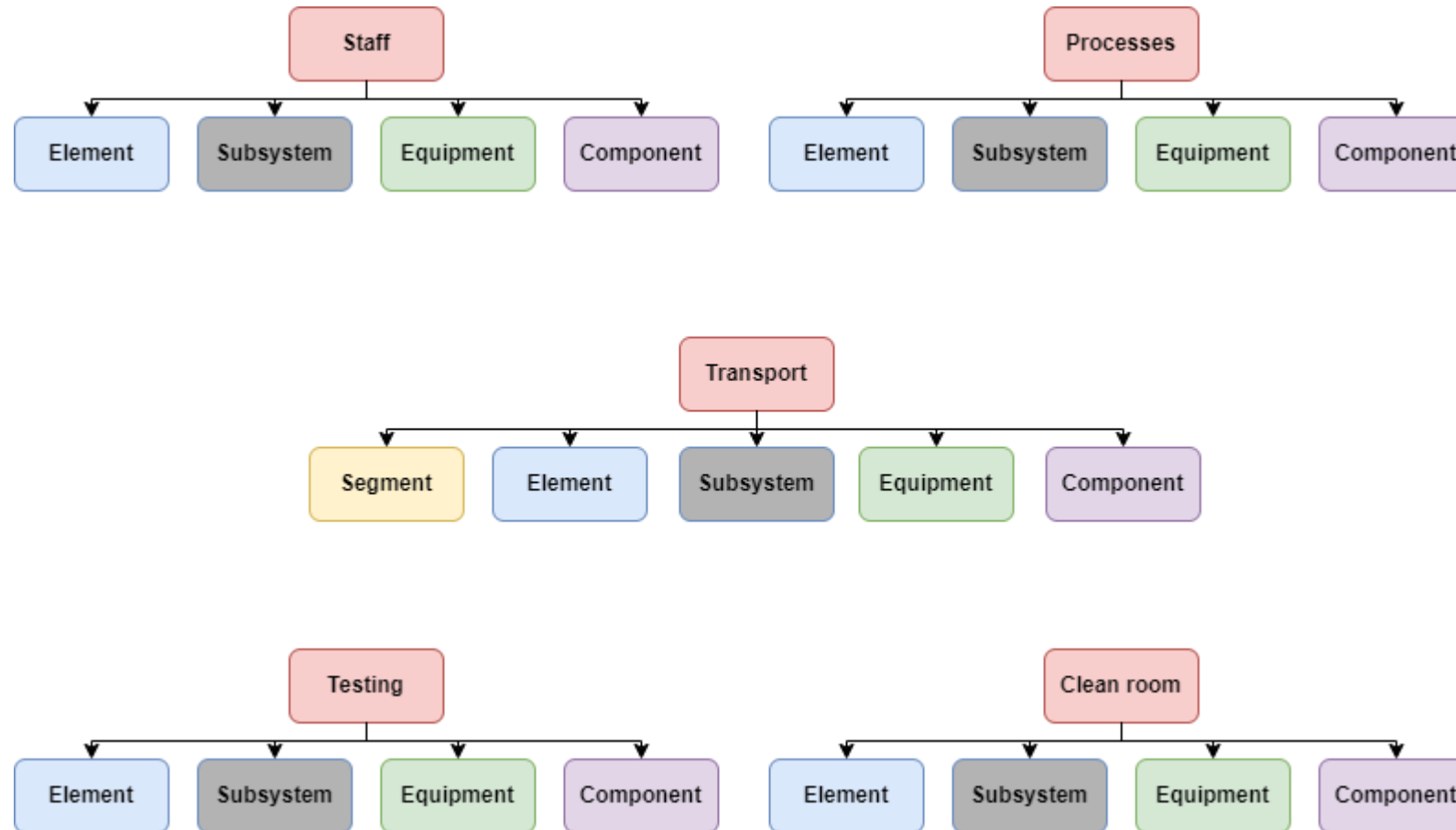
# Structure of the LCA model







# Structure of the LCA model





**Thank you for your  
attention!**

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