Title: Life-LCA: The first case study of the life cycle impacts of a human being

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Increasing environmental awareness by making the individually caused ecological damage measurable, tangible and showing optimization and reduction potential in detail

- Private consumption is responsible for approx. 64% of the global CO$_2$ emissions
- ca. 50% of these emissions are caused by the richest 10% of the world’s population (Oxfam, 2015)
Goal and Scope: System boundaries

**Life stages**
- Birth to 17 years
- 18 to 39 years
- 40 to 59 years
- 60 years to EOL

**Specific consumption patterns for different life stages**
- product a
- product b
- product c
- ...
- product a
- product d
- product e
- ...
- product d
- product f
- product g
- ...
- product d
- product g
- product h
- ...

**Dimension 1**
- Human Life Cycle
  - Birth to 17 years
  - 18 to 39 years
  - 40 to 59 years
  - 60 years to EOL

**Dimension 2**
- Product Life Cycle
  - Production
  - Use-Phase and maintenance
  - Recycling
  - Processing
  - Raw Material Extraction
Goal and scope - System boundaries and data collection

Baseline scenario (2017)
- 2 month monitoring period
- Identifying hotspots

Optimized scenario (2018)
- Measures catalogue for sustainable consumption
- 2 month monitoring period
- Reduction potential

Life-LCA
- From birth until his current life year
- Retrospective
- High uncertainties in early childhood and youth stage

Monitoring
- Continuously and discontinuously consumed products (product life span < 1 year)

Acquis
- Irregular consumption (product life span > 1 year)

Retrospective
- Based on memories or records
### Product category

| Product category                          | Clusters (n) |
|------------------------------------------|--------------|
| clothes and jewelry                      | 23           |
| cosmetics, hygiene and cleaning          | 17           |
| electronics                              | 15           |
| energy and water                         | 6            |
| food                                     | 41           |
| health and medical equipment             | 5            |
| hobbies, leisure and pet                 | 29           |
| house                                    | 16           |
| living, household and home office        | 49           |
| transport                                | 12           |

#### Example product cluster

Cluster X covers the product category “food” which refers to tropical fruits, e.g., oranges, kiwis, pineapples, etc.

#### Similarities in functionality, material or composition

- Product a
- Product b
- Product c
Goal and Scope - data calculation and allocation

Included
- Direct impacts at work and business trips
- Total allocation of his childhood and pets to himself
- Estimated product use ratio

Excluded
- Old adulthood stage and death
- Financial investments
- Goods received as inheritance
- Prenatal phase and birth
- Indirect impacts due to work-related decisions
- Transports from birth to 18 years

Impact categories:
- Global Warming Potential (GWP)
- Acidification Potential (EP)
- Eutrophication potential (EP)
- Photochemical Ozone Creation Potential (POCP)
**Results - Life-LCA: birth to current life year**

- **GWP**: 1,140,000 kg CO2-eq.
- **AP**: 4,480 kg SO2-eq.
- **EP**: 1,690 kg PO4-eq.
- **POCP**: 537 kg C2H4-eq.

### Relative shares of the product categories (%)

- **Transport**
- **Energy and Water**
- **Food**
- **Hobbies, leisure and pet**
- **House**
- **Electronics**
- **Living, household and home office**
- **Clothes and jewelry**
- **Cosmetics, hygiene and cleaning**
- **Health and medical equipment**

### Product category

| Product category          | Main contributor                                      |
|---------------------------|-------------------------------------------------------|
| Transport                 | 9 cars over 30 years Business flights                 |
| Food                      | Diary products                                        |
|                           | Meat                                                  |
|                           | Coffee                                                |
| Energy and Water          | 1986-2014 oil for heating and conventional electricity |
| Hobbies leisure and pet   | Pets (mainly his current dog)                         |

Average yearly impact of around 23.3 t CO2-eq., which is more than twice of the average German (UBA 2019)
## Results - Baseline scenario (BS) vs. Optimized scenario (OS)

| Product category                      | GWP [kg CO₂-eq.] (baseline scenario) | GWP [kg CO₂-eq.] (optimized scenario) | Difference [%] |
|---------------------------------------|--------------------------------------|----------------------------------------|----------------|
| transport                             | 18,628                               | 3,484                                  | -81           |
| food                                  | 2,560                                | 738                                    | -71           |
| hobbies, leisure and pet              | 921                                  | 469                                    | -49           |
| clothes and jewelry                   | 96                                   | 70                                     | -28           |
| cosmetics, hygiene and cleaning       | 88                                   | 70                                     | -20           |
| energy and water                      | 4,214                                | 3,418                                  | -19           |
| house                                 | 641                                  | 641                                    | 0             |
| electronics                           | 374                                  | 381                                    | +2            |
| health and medical equipment          | 0,6                                  | 0,75                                   | +20           |
| living, household and home office     | 95                                   | 230                                    | +59           |
| SUM                                   | ≈ 27,600                             | ≈ 9,500                                | -66           |

### Measures for optimization
- Disbanding flights
- Almost vegan diet
- New dog feed
- Face to Face Meetings
- Replacing heating system

**BS vs. OS: Reduction in between 59-66% for all impact categories**

**GWP:**
Baseline scenario: Transport, energy and food have a total share of roughly 90%

**GWP:**
OS vs. BS: 20% lower than the average German (per year).
Conclusion and remaining challenges

• First insights how to practically apply a LCA approach on a human being
• Performance tracking, revealing of reduction potentials, and the identification of possible trade-offs were possible
• Better identification of the analyzed person with its caused impacts
  – led to significant positive changes in the study object`s consumption pattern

Remaining challenges

• High data uncertainties for the childhood and youth stage
• More case studies of persons with different backgrounds, ages or lifestyles necessary
• Improvement of data quality
• Future studies should also consider additional impact categories

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Thanks for your attention!

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