A life cycle perspective, looking beyond our noses to better assess the environmental impacts of our actions

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CIRAIG Factsheet

Multidisciplinary world-renowned research centre
130+ professors, researchers and students
10 universities, 7 Chairs, 5 research units
Member of the UNEP/SETAC Life Cycle Initiative
Numerous collaborations (Canada, USA, Europe)
110+ applied research projects (industries and govs)
Volume of business in 2009: 2.5M$+ (CIRAIG-Poly)
LCA expertise: energy, waste management, pulp and paper, mine and metals, urban infrastructure management, green buildings

Research  Training  Tech. transfer  Communication

www.CIRAIG.org
International Chair on Life Cycle Assessment

« [...] the world`s largest private investment in LCA research. »
Guido Sonnemann - UNEP
Unrestrained Rate of Growth

Source: Millennium Ecosystem Assessment
« What we do, as a society, is transform resources into waste. 
The process is measured at the cash register. 
What we actually measure is the rate at which this transformation takes place. »

Anders Moberg, former president of IKEA
Finding Real Solutions

Zero emissions

OR emissions elsewhere!

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<table>
<thead>
<tr>
<th>Environmental Problem Shifting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In time</strong></td>
</tr>
<tr>
<td><strong>In space</strong></td>
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<tr>
<td><strong>To other emissions</strong></td>
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<td><strong>To other media</strong></td>
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<tr>
<td><strong>To other impacts</strong></td>
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<tr>
<td><strong>To other consumption patterns</strong></td>
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A Global Perspective = A Life Cycle Perspective

Cradle To Grave

Resource Acquisition
- Extraction
- Transformation

Manufacturing
- Assembly
- Packaging

Distribution
- Storage
- Handling
- Transport

End-of-life management
- Collection
- Recovery / Valorization
- Recycling
- Landfilling

Use
- Maintenance
- Repair
- Reuse

IMPACTS
Simple Common Sense?

- Restoration (Clean-up)
- Emissions Reduction (End-of-pipe)
- Pollution Prevention

Cleaner Production
Design for the Environment
Extended Product Responsibility
Green Chemistry
The Problem Is...

Must have the right information

Otherwise

- Wrong priorities
- Waste limited resources
- Might even make things worst
## How to Get the Right Information?

<table>
<thead>
<tr>
<th>Tool</th>
<th>Subject</th>
<th>Scale</th>
<th>Impacts considered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Assessment</td>
<td>Installation, substance</td>
<td>Local or regional</td>
<td>Toxicity (eco-)</td>
</tr>
<tr>
<td>Environmental Impact Assessment</td>
<td>New localized activity</td>
<td>Local or regional</td>
<td>Variable</td>
</tr>
<tr>
<td>Life Cycle Assessment</td>
<td>Product, service (= system)</td>
<td>Global (life cycle)</td>
<td>Multiple</td>
</tr>
</tbody>
</table>

The Basis of LCA

Environmental impacts $\rightarrow$ Disturbances in natural processes due to environmental interventions from human activities

LCA $\rightarrow$ Accounting for the environmental interventions associated with the life cycle
Life Cycle Inventory

Inputs
- Natural Resources
  - Iron ore
  - Crude oil
  - Timber
  - Water
  - Solar energy
  - Land use

System Boundaries

Product System
- Resource Acquisition
- Manufacturing
- Distribution
- Use
- End-of-life

Outputs
- Emissions to the
  - Air: CO₂, SO₂, PM, COV
  - Water: PO₄, NO₃
  - Soil: Pesticides, Metals
- Other interventions
  - Heat/Radiations
  - Noise

Product’s Function
Inputs and outputs related to a given «amount» of function = Functional Unit
Life Cycle Impact Assessment

**Inventory**

**Inputs:**
- Iron ore
- Crude oil
- Timber
- Water
- Solar energy
- Territory
  - ...

**Outputs:**
- CO$_2$
- SO$_2$
- PM
- COV
- PO$_4$
- NO$_3$
- Pesticides
- Metals
  - ...

**Impact categories**
- Global warming
- Ozone layer depletion
- Land use
- Natural resources depletion
- Aquatic acidification
- Eutrophication
- Photochemical ozone formation
- Human toxicity
- Ecotoxicity

**Single score**
A Short History

1975
Coca-Cola, USA
*Resource and Environmental Profile Analysis*

1984
Switzerland
Ökobalanz

1997-2000
ISO 14040 series

2002
Life Cycle Initiative

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« Develop production and consumption policies to improve the products and services provided, while reducing environmental and health impacts, using, where appropriate, science-based approaches, such as life cycle assessment. »
(16) «Internalization of costs»
The cost of goods and services must reflect all the costs they generate for society during their whole life cycle, from their design to their final consumption or disposal.
European Platform on LCA

Project of the European Commission
1st Phase: 2005-2009

To improve the **credibility, acceptance and practice of LCA** in business and public authorities, by providing **reference data and recommended methods** for LCA studies

To support the implementation of the **Thematic Strategies on the Prevention and Recycling of Waste** and on the **Sustainable Use of Natural Resources**, the **Integrated Product Policy (IPP) Communication** and of the **upcoming Sustainable Consumption and Production (SCP) Action Plan**
Who uses LCA?
Walmart is getting into it!!!

Wants to obtain LCA data for all products

⇒ 1000’s of suppliers

Funds LCA research and tools
RONA too!

RONA-ECO and Eco-Responsible Choice lines

Chosen according to life cycle approach
Switzerland Environment Label for Vehicles

Now **Energy Label** (only CO₂)

From 2010 **Environment Label**
Must account for GHGs, air pollutants, noise and fuel production
Emissions expressed as ecopoints per vehicle
Ordinance RS 641.611 on mineral oil taxation (Art. 19)

Biofuels get tax exemption if:

- They emit 40% less GHGs, from production to use, as compared to fossil fuels
- Their environmental impacts, from production to use, are not notably higher than those of fossil fuels
- Their production does not pose a threat to tropical forests and biodiversity
California’s Low Carbon Fuel Standard (LCFS)

Approved by CARB on 23-04-2009

Requires 10% reduction of fuels carbon intensity by 2020

Takes into account GHG content of every aspect of fuel - its production, distribution and combustion

Biofuels are included
Agency will measure GHG emissions based on a biofuel's entire lifecycle, from cultivation to fuel production to vehicle exhaust.

Cultivation includes direct emissions from fertilizer and tractor fuel, as well as emissions from indirect land use change, which is the impact that growing biofuels domestically has on other countries.
Consumer Use of LCA

Ecolabel

Environmental Choice

Green Seal (USA)

Shows environmental preference in specific product category
Threshold criteria
Verified by third party

Environmental Product
Declaration

Based on LCA
Very simplified LCA report
Verified by third party
Governed by ISO 14025

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Futur of Environmental Labelling

Environmental Facts

Overall Weighted Score .................................................. 8 / 10

Energy

Embodied energy ...................................................... 2,800KWh
Type of energy used: 2,000KWh coal, 800KWh solar PV
Energy usage, avg. est. ............................................... 1,900KWh/yr
Transportation origin
Product: USA
Materials: USA, China, Korea, South Africa

Resources

Product
Mass ................................................................. 10kg
Non-virgin material .................................................. 5%
Recyclable/Compostable material .................. 30%
Ingredients: Polyethylene terephthalate (PET), aluminum, steel, glass, copper, fiber glass, acrylonitrile-butadiene styrene (ABS), lead-free solder, nematic liquid crystals, polyimide, indium-tin oxide, Polycarbonate, Poly(methyl methacrylate) (PMMA), Styrene-butadiene co-polymer, Polyethylene ether, Triphenyl phosphate, polybrominated flame retardant, silicon, silicon dioxide, silicon nitride, selenium, cadmium, antimony, dopants
Life Expectancy ...................................................... 4-7 yrs
End-of-life ............................................................. return to manufacturer

Packaging & Misc.
Mass ................................................................. 800g
Non-virgin material .................................................. 20%
Recyclable/Compostable material .................. 100%
Ingredients: cardboard, paper, PLA plastic
End-of-life ............................................................. recycle, compost

Toxins

Restricted/Toxic ingredients: polybrominated flame retardant, cadmium, antimony, dopants
Restricted/Toxic production waste: toluene, mercury oxides, cadmium, antimony, arsenic, arsenic, chlorine, phosgene, perfluorocompounds (CF₃, C₂F₆, NF₃, SF₆, CHF₃)

Water

Embodied water ....................................................... 2,600L
Water potability ....................................................... 4 / 10

Social

Labor Practices ......................................................... 8 / 10
Fair trade ............................................................... 4 / 10
Transparency .......................................................... 6 / 10
Japan LCA National Project

Project of the Ministry of Economy, Trade and Industry (METI)

1st Phase: 1998-2003

To develop national inventory database and reliable LCA methodology for Japan

Sectors included: automotive, pulp and paper, food, plastics, electric and electronic equipment, metals, construction
Earthster Project

1. Define your process

2. Contribution analysis and comparison

3. Publish cradle-to-gate results

4. Link to your supplier’s data ➔ re-compute, re-publish
Concluding Remarks

LCA fills a void in environmental assessment toolbox as it is the only tool that gives a global perspective and captures problem shifting situations.

Global trend in industries and governments.
Thank you for your attention