

Life cycle assessment and sustainability

The short essay below by Gabor Doka of Switzerland is a concise summary of some of the issues of concern in relation to Life Cycle Assessment (LCA) and its use in determining sustainable practices or evaluating the sustainability-related aspects of products. The essay that follows is based on a comment on an email listerv on LCA.



Doka
Life Cycle Assessments
Zurich

Normalising impact assessment results against sustainable levels

Any LCA study is a big funnel for data. From several thousand processes, with several hundred environmental interventions, we calculate impacts to several dozens of environmental effect categories such as Global Warming, Acidification, or water consumption. It is difficult to interpret the category results at this point, since they have very different physical units. One simple way to make category results more graspable is called Normalisation. In Normalisation we divide the category results we obtained for our object of study by the category results of some specified reference. That reference is most usually the category results for a whole region, e.g. the whole of Europe for a year, or alternatively the category results e.g. per average European inhabitant per year. Normalisation then answers the question "How large is the contribution of my object of study compared to the current annual impact in Europe".

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The normalisation step is an *interpretation aid* for life cycle inventory (LCI) results. That a process emits 0.5 kg of lead might not mean much to a layman. But if you can say, "The process emits as much lead as 14 average Europeans annually", that's a better way to be able to grasp what "0.5 kg lead" mean. This is essentially what the ISO standard suggests:

"The aim of the normalization of indicator results is to better understand the relative magnitude for each indicator result of the product system under study (ISO 14042, chapter 6.2)"

ISO also states that normalisation is optional. There is no mandatory choice of Normalisation value. The use of the *current annual* emissions in Normalisation is a common procedure, which has proven helpful. But other choices are possible. What happens if not *current* levels were chosen, but some target levels; levels that could represent an *acceptable or sustainable level of impact*? Could such a procedure be helpful in assessing if a certain product is sustainable? From the understanding of normalisation as an interpretation aid, it is reasonable that we choose something that really increases understanding: we probably have a better grasp on how large *current* emissions *are* (normalisation with current annual emissions), than on how large they *ought to be* (normalisation with sustainable levels).

Having said that, I have much sympathy for working out ways where LCA not only tells us which options might be environmentally preferable over another, but also what level of consumption of those options could be called "sustainable".

Currently in LCA we usually point out options that are "environmentally better" *i.e.* less burdening than others. In effect, LCA tells us which *direction* to go if we want to reduce burdens. LCA does *not* tell us *how far* we have to go in reducing the burdens to be sustainable. It is nice to have products that burden the environment 10%, 20% or even 50% less than the common option. But can we tell from *that* whether these products really are "sustainable"? Maybe a 50% reduction - though impressive - is not enough.

Long-term, sustainable consumption would mean that every person on the planet can consume a range of products and services and that the cumulated burden of the totality of all those products does not exceed the given natural buffering capacities of the planet. Obviously judging sustainability or non-sustainability then depends on a number of very heterogeneous factors:

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1. What range of products is consumed by a person
2. How often per time unit those products are consumed (consumption intensity)
3. How we manufacture those goods (and dispose of them)
4. How many people there are on the planet
5. The extent of the natural buffering capacities of the planet (which may not be constant)

That list is my mutated offspring from the I=PAT formula of (Holdren & Ehrlich 1974).

LCA currently is focused on points one and three: We give out tips, which product choices might be environmentally favorable, and we can suggest improvements of production methods. But LCA completely ignores time aspects and thus consumption intensity (point two).

From the list above it is also clear that "sustainability" can only be judged appropriately, if the *annual sum total* of inflicted damages is assessed. And we need to weigh this sum total against the natural buffering capacities of the planet. Thus we have to look not at the consumption intensity of *one* product alone, but of all consumption. It is absurd to label one single product "sustainable" or "not sustainable". Only whole lifestyles (with set boundary conditions on total population and state of the planet) could be labeled sustainable. Everything's connected. Nothing new there :-)

The Ecological Footprint Method for nations does a good job of highlighting these quite simple connections: If a nation's population consumes annually more than what the land is giving them per year, they need to compensate with imports from other countries (GFN 2007). If the whole planet consumes more, we need to "import" from the extra-terrestrials :-)

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You can see from that how LCA is ill-equipped to judge "sustainability":

- A common focus on individual products, but not whole consumption patterns of people
- A lack of a temporal resolution, to judge consumption intensities and mass flows *per time* instead of mass flows per product unit. Also to judge time lags in burden generation (burdens from today's products might be occurring many centuries from now – think of landfills).

Some aspects of time-lags can be alleviated, if we assume a variation of Kant's imperative: *we are living sustainably, if future generations would judge our behaviour as sustainable*. If a lifestyle can be considered a sort of template, by which even far future generations can live by and keep on living with constant environmental quality, then this lifestyle can be considered sustainable. In a long-term, continuous civilization, every burden counts, regardless of *when* exactly it becomes effective. At any one time in this civilization the inflicted burden is a sum of currently-caused burdens and of the time-lagged burdens of past generations. In this perspective then, the exact magnitude of time lags are not so relevant. (There is still the problem of population size, which cannot grow indefinitely and variable global burden buffering capacities, which might not be constant).

(I'm not advocating that every person on the planet should have *identical* lifestyles to be sustainable. Diversity of lifestyles can persist on a sustainable planet, if we manage the inequalities fairly. It's just easier to refer to one "global average", template lifestyle).

Gabor Doka, Switzerland, November 2007

<http://www.doka.ch/lca.htm>

References:

Holdren J. P., Ehrlich P.R. (1974) Human population and the global environment. *American Scientist* 62, 3: 282-292.

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