CrossMark

LETTER TO THE EDITOR-IN-CHIEF

On criteria for the evaluation of life cycle assessment software

Reinout Heijungs[1,2] ⓘ

Seto et al. (2017) present an analysis of five software packages for life cycle assessment (LCA). They point out that LCA software should not only be compared in an abstract way. Indeed, the analysis by Ciroth (2012) might be regarded as a bit clinical, as the proof of the pudding is in the end supposed to be in its eating. Three other recent publications (Speck et al. 2015a, b and Herrmann and Moltesen 2015) in fact concentrate on the results delivered by different software. It is strange that Seto et al. (2017) seem to be unaware of these articles. But even stranger is the angle from which they approach the issue, its applicability to concrete. While I acknowledge that Ciroth (2012); Speck et al. (2015a, b) and Herrmann and Moltesen (2015) overlook certain important elements in the discussion, I am afraid that Seto et al. (2017) do not provide a remedy. Instead, they make the discussion more obscure by introducing a highly debatable and highly biased framework for comparison, as to some extent been pointed out by Goedkoop (2016) before.

First, *The International Journal of Life Cycle Assessment* is a scientific journal addressing the LCA community, not a journal for the concrete industry. If this article would have appeared in an International Journal of Concrete Assessment, it would have merit, but for the readers of the present journal, it is not interesting at all, because it does not tell you which software is good for anything except Canadian concrete. It is even misleading, because the title of the article suggests that it is about "criteria for the evaluation of life cycle assessment software packages and life cycle inventory data," and that concrete is only an "application."

Next, although the abstract innocently mentions that "software package C" performed best, a closer look reveals that there is a suspicious connection at work: software package C is in fact GaBi, and the responsible editor of this article was Martin Baitz, who happens to be employed by Thinkstep (2017), the company behind GaBi. I would have hoped that not only authors should comply with ethical standards and notify potential conflicts of interest, but that this also applied to the responsible editor. Even if Dr. Baitz took a neutral position (which I assume), the storyline is unacceptable, just because there is an obvious conflict of interest.

Third, I strongly disagree with the criteria used. And criteria is in the title and it is a keyword, so this is obviously important to the paper. The paper emphasizes criteria that are irrelevant. Availability of databases is totally unimportant in the context of assessing programs. The information on the FAQ-page of CMLCA (2017) summarizes my argument for many years already: "Q: How many processes are there in CMLCA?" and "A: Anything between 0 and four billion. CMLCA is a program, like MS Word, it is not a database. It does not make sense to ask "How many documents are there in Word?" just because the program is empty, while you can open, create, and import an unlimited amount of documents. Likewise for CMLCA: it is empty, but you can open, create, and import an unlimited amount of processes. There are standard ways of importing process data, e.g., from ecoinvent." The argument above applies to all software for analysis, whether it is Excel, SPSS, GaBi, or SimaPro. Of course you can download and open Excel files, SPSS data files, GaBi projects, and SimaPro projects. But the software does not (in case of Excel and SPSS) or should not (in case of GaBi and SimaPro) contain it.

✉ Reinout Heijungs
heijungs@cml.leidenuniv.nl; r.heijungs@vu.nl

1 Institute of Environmental Sciences, Leiden University, Leiden, The Netherlands

2 Department of Econometrics and Operations Research, Vrije Universiteit Amsterdam, Amsterdam, The Netherlands

Development of criteria for software assessment is important. Such criteria would need to include the question if the software anyhow gives the correct answer. The work by Speck et al. (2015a, b) and Herrmann and Moltesen (2015) suggests that this is not always the case, because GaBi and SimaPro in certain cases disagree by a factor as large as 10^9. Probably, such deviations are more due to an incorrect implementation of the data (unit process data or characterization factors) than to bugs in the program code or incorrect algorithms. However, especially in large systems, numerical artifacts may easily pop up (Heijungs et al. 2015). A systematic comparison of software on the quality of the outcome is still needed.

A second criterion that is unmentioned so far is the extent to which the software can handle unit processes, including systems with loops (Heijungs 1994). I have been told that some programs, including GaBi, are not able to do computations with the unit processes of ecoinvent, but can only work on the pre-aggregated LCIs. Again, in an applied domain like cement and concrete, this might be okay, but in a serious scientific context like that of *The International Journal of Life Cycle Assessment*, this sounds like a serious shortcoming. Perhaps *The International Journal of Life Cycle Assessment* should revisit its quality guidelines also in terms of the allowed software.

References

Ciroth A (2012) Software for life cycle assessment. In: Curran MA (ed) Life cycle assessment handbook. A guide for environmentally sustainable products. Scrivener Publishing LLC, pp 143–158

CMLCA (2017) http://www.cmlca.eu/ Accessed 24 April 2017

Goedkoop M (2016) In response to "criteria for the evaluation of life cycle assessment software packages and life cycle inventory data with application to concrete" by Seto et al. Int J Life Cycle Assess 21:1213–1214

Heijungs R (1994) A generic method for the identification of options for cleaner products. Ecol Econ 10:69–81

Heijungs R, de Koning A, Wegener Sleeswijk A (2015) Sustainability analysis and systems of linear equations in the era of data abundance. J Env Acc Man 3:109–122

Herrmann IT, Moltesen A (2015) Does it matter which life cycle assessment (LCA) tool you choose? A comparative assessment of SimaPro and GaBi. J Clean Prod 86:163–169

Seto KE, Panesar DK, Chuchill CJ (2017) Criteria for the evaluation of life cycle assessment software packages and life cycle inventory data with application to concrete. Int J Life Cycle Assess 22:694–706

Speck R, Selke S, Auras R, Fitzsimmons J (2015a) Life cycle assessment software. Selection can impact results. J Ind Ecol 20:18–28

Speck R, Selke S, Auras R, Fitzsimmons J (2015b) Choice of life cycle assessment software can impact packaging systems decisions. Packag Tech Sc 28:579–588

Thinkstep (2017) http://www.thinkstep.com/ Accessed 24 April 2017