
Letter to the Editor

Udo de Haes, H. A. 1997. **How Severe Are the Constraints of Life-Cycle Impact Assessment?** Letter to the editor regarding J. W. Owens's (Winter 1997) "Life-Cycle Assessment: Constraints on Moving from Inventory to Impact Assessment," *Journal of Industrial Ecology* 1(1): 37–49.

In the first issue of JIE, Owens discussed the constraints of the impact assessment phase in Life Cycle Assessment (LCA). There are many points where I can agree with him. Thus I can well agree that life cycle impact assessment (LCIA) cannot predict actual impacts, i.e. impacts which can be measured in relation to magnitude of the processes of the product system involved. As Owens states correctly, this is due to a number of characteristics of the life cycle inventory, in particular the functional unit based calculations, to the allocation procedures dealing with multiple processes, i.e., processes which produce more than one product, and to the aggregation of environmental burdens over the different stages of the life cycle. In addition he correctly notes the fact that there are large differences in the scientific basis for modeling the impacts in different impact categories. Some categories have a rather strong basis, aggregating different substances on basis of homogeneous mechanisms; examples are the well known Global Warming Potentials and Ozone Depletion Potentials. Other categories also perform such aggregation but lack a fate assessment, like acidification, or include clear value judgments, like eco- and human toxicity.

Due to these characteristics of both life cycle inventory and life cycle impact assessment, Owens argues, that the results of the latter phase should be called "numerical indicators" or "pressure indicators", rather than "impacts". In this way confusion can be avoided with changes in the environment which can directly be measured in relation to a given activity, such as is the case with Risk Assessment. I think this is a useful proposal; for the same reasons, in ISO the term "life cycle impacts" has been coined, addressing the same warning (ISO/CD 14042).

The main conclusion of his article however is, that the given characteristics result in such a subjective and uncertain outcome that it severely limits the ability of LCA to compare different products with respect to their environmental behavior. For internal uses such as the design of products, LCA can be used, but not so for public comparisons. Or more precisely, or these public applications LCA cannot be used as a stand alone tool.

I want to make two comments on this line of reasoning. My first comment regards Owens problem with the subjectivity of life cycle impact assessment methods and uncertainty of the results. Indeed, on many points choices are made, which are not based on pure science, and many uncertainties remain. But in fact this is a characteristic of all decision support tools. Also in environmental risk assessment and environmental impact assessment it is increasingly acknowledged that value choices do play a role and that not all uncertainties can be removed by better science. LCA can also learn from these other tools how this problem is coped with. A good example concerns Environmental Impact Assessment. This tool functions quite well in a number of European countries, despite its subjectivity and its

uncertainties, because it is embedded in a well structured and neutral decision procedure. Thus the limitations are not only dealt with by adding more science, but rather by improving the procedure in which the tool is used. For the credibility of the results that should have a very high priority. For the use of LCA an example of such a balanced procedure, warranting against undue company influences, concerns a number of European ecolabeling schemes.

My second comment concerns Owens' remark that LCA cannot be used as a stand-alone tool for public comparisons. Of course, if other tools can offer useful information, they should be used. It is an important field for further research to investigate where additional use - not integration! - of different tools may be fruitful. But we should bear in mind that LCA is the only tool for the comparison between products as systems of processes from cradle to grave. It is the comparison between product systems itself, with their cradle-to-grave character, which sets the limits. The methodological difficulties are not created by LCA; the uncertainties are always there, they just come into the open by the LCA process because of its formal and explicit character. Thus, if we want to make a comparison between such systems, LCA has by its very nature to offer the relevant information. If in addition we are interested to know more about local conditions, we can leave the systems approach and perform risk analyses for the separate unit operations involved. This can be very relevant, but I do not regard it as a prerequisite for a comparison between the systems as a whole. For a good understanding of this line of reasoning it should be noted, that the methodology of LCA impact assessment can surely be improved in a number of ways. Not all limitations are inherent characteristics of the different impact categories, as is suggested by Owens. Thus, the integration of data over life cycle phases does often not take place any more, leaving room for the assessment whether emissions take place in sensitive or in non-sensitive areas (cf. Nichols et al., 1996). And simple adding of substances on basis of their toxic potency is increasingly replaced by aggregation on basis of models in which also the persistence or fate of the substances in the environment is taken into account (cf. Guinee et al., 1996). But decisions are taken every day and will not wait for improved methods. So if a choice between product systems as a whole is to be made, LCA should in its best present form give the core of information, and this should be performed in a decision procedure which warrants as much as possible against inadvertent or deliberate misuse.

References

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