

On the Usefulness of Life Cycle Assessment of Packaging

REINOUT HEIJUNGS*

JEROEN B. GUINÉE

Centre of Environmental Science
Leiden University
P.O. Box 9518
2300 RA Leiden, The Netherlands

ABSTRACT / In reaction to a paper in *Environmental*

Management in which the sense and sensibility of environmental assessments of packaging were questioned, it is argued that these types of assessments may be very useful, provided the relevant types of questions are posed. These boundary conditions are discussed, along with an overview of more recent methodological developments with respect to environmental assessment of products.

In an issue of *Environmental Management*, Kooijman (1993) discusses a number of arguments that could induce people to believe that it is useless and fruitless to spend time in assessing packaging with respect to environmental properties.

Kooijman discusses some aspects of environmental assessment of products in general, focusing on packaging. We add a number of standard references, which have appeared during the last two years, and of which Kooijman is apparently not aware, and pose some critical notes to some key issues of his paper. Although he makes a number of good points, we would like to explain why his overall conclusions are too strong.

On Methodological Development of Environmental Assessments of Product

Life cycle assessment (LCA) is the currently widely accepted term for environmental assessments of products on a cradle-to-grave basis as described by Kooijman. For a novice in the field, Kooijman's statements on the state-of-the-art of this type of assessments may be disappointing. This is due to an incomplete overview of the developments with respect to LCA in the early 90s. Below, we provide a brief summary of what we consider to be the most relevant sources.

We have been involved as the first two authors of a report, commissioned by the Dutch government, to

design an improved methodology for LCA (Heijungs and others 1992). Similar projects in other countries have resulted in similar reports. Examples are: the one prepared for the Nordic Council (Anonymous 1992), that of EPA (Vigon and others 1993), and the one prepared for PWMI (Boustead 1992). The Canadian Standards Association is currently working at such a report. A standard framework and terminology is provided by the fairly broad accepted Code of Practice of the Society of Environmental Toxicology and Chemistry (SETAC) (Consoli and others 1993). Concise surveys of methodology in a broad sense are provided in the form of a paper by Guinée and others (1993a,b).

Kooijman criticizes in particular what he calls the assessment stage and states that this procedure is not feasible. Impact assessment, as it is now generally coined, is in rapid development. We mention a few recent activities. In February 1992, an expert workshop was held in Sandestin, Florida (Fava and others 1993). In the already mentioned Nordic report, an extensive chapter is devoted to impact assessment (or classification, as it is called there) (Finnveden and others 1992). Our report (Heijungs and others 1992) provides an extensive operational method for a similar type of classification. In January 1993, an expert's workshop was held in Lyngby, Denmark, on the topic of ecotoxicity assessment in LCA (Bro-Rasmussen and others, 1995). In the SETAC-Europe LCA news, a call for experts was readily answered (de Oude 1993). SETAC and the International Organization for Standardization (ISO) are initiating working groups to address this issue. The conclusion here is that this component is in rapid development and is a crucial part of LCA.

KEY WORDS: Life cycle assessment; Packaging; Products

*Author to whom correspondence should be addressed.

On the Environmental Assessment of Packaging

So much for the background of LCA. Our criticism concerns the contents. Kooijman argues that it is wrong to make an environmental assessment of packaging and that one should study the total food system instead of a selected part of it. He essentially gives two reasons for this:

- the packaging typically represents a small portion of the environmental problems of the food system;
- environmental assessment of the packaging cannot be isolated from the food product it contains.

On the Relevance of Irrelevancies

We agree that it will often appear that the food product itself has considerably more environmental impact than the packaging. This fact may, however, not lead to an apathetic attitude. Seen in a broader perspective, food products are responsible for only a small part of the environmental impacts caused by the total industry and transportation. Still, many people, including Kooijman, direct their attention to analyzing and reducing the environmental impacts of food products. Rightly, their attitude is inspired by the belief that we have to improve the entire economic system. We therefore do not see why analysis of packaging, if possible, is senseless.

It can easily be conjectured that there is an issue with a relevance that is between the food *pur sang* and the package *pur sang*: the form in which the food is conserved. Desiring to buy peas, a consumer has the choice between fresh, frozen, dried, and retort-preserved peas. The choice is seldom motivated by environmental arguments. Only for the same type of food (peas), provided in the same form (retort preserved), is the choice between different package materials (tin, glass), in practice, influenced by environmental considerations. Kooijman neglects this intermediate level of environmental concern.

Of course, the reasons for spoiling of 5%–30% of milk, and for spoiling 70 million kg of bread have to be investigated. Wasting of food means that substantial parts of the emission of chemicals and extraction of resources have been in vain. It may be that the introduction of other sizes of packaging can decrease this stream of wasted food. However, if it is concluded that, for example, 0.75-liter packaging would largely solve this problem, we still would have to decide on

the packaging material. It also could turn out that large product losses cannot be avoided despite adjustment of package size. The packaging of the food product remains an interesting problem, which can be studied independently of product losses caused by inappropriate packaging size.

On Isolating Content and Packaging

We agree that, even if we compare packages of the same size, it may happen that different packaging materials have different properties with respect to product loss, for instance, because of clinging of yogurt to packaging. One might be tempted to incorporate this in the assessment without analysis of the food product itself. Rightly, Kooijman's point is that the differences in adhesive properties of packaging alternatives give rise to different amounts of food spilling. Assume that drinking 1000 liters of milk requires 1050 one-liter bottles or 1025 one-liter cartons. This can only be taken into account by calculating and adding the impacts of 25 liters of milk to the impacts of 1050 bottles.

We hold, however, that the aim of the assessment determines whether and how this should be taken into account. It will seldom occur that a family wants to drink exactly 1 liter of milk at lunch. Instead, they have a container with approximately 1 liter, and pour out a number of glasses. If there is a little more, the question will be asked: "Who wants the last half cup?" In contrast, if 5% of the milk clings to the packaging, they just drink a little bit less. They do not buy an additional bottle. They will buy another bottle of course, when only 50% of that package size of milk can be consumed.

It is difficult to fix a boundary between the situation where it matters, and the situation where it does not. This largely depends on the particular situation. In a canteen, a fixed number of consumptions is required, so that a loss of 1% due to clinging may indeed result in 1% more purchasing. For a small family, a loss of 5% may have negligible effects. It thus will depend entirely on the aim of the study if product loss be part of the assessment. It is conceivable that LCA tells us that a household should prefer glass bottles, whereas canteens should prefer carton packages. The environmental truth is user-dependent and thus context-sensitive. This may have consequences for an ecolabeling system.

This argument may be extended to Kooijman's statement that a small package may in some cases be better than a large one. We completely agree with this,

and we hope that LCA will not be used to prove that large packages are better than small ones.

The essential ingredient in LCA to avoid obtaining such nonsensical results is the functional unit. The functional unit is the basis of the comparison. It has been introduced because it does not make sense to compare one returnable glass bottle with one one-way carton packaging. The functional unit in Mekel and Huppés (1990) was defined as the packaging of 1000 liters of milk. This functional unit was used to compare 1000 one-liter carton packages with 33.3 one-liter glass bottles, assuming a trip rate of 30, and with 13.3 one-liter polycarbonate bottles, assuming a trip rate of 75. In principle, this functional unit would allow the comparison of 2-liter bottles as well, or even the comparison of a 1-liter bottle with a 2-liter bottle. As the actual alternatives were all of the 1-liter model, the functional unit did not explicitly exclude this. The important thing is that only 1-liter bottles were compared, as they were considered functionally equivalent. Only if the packaging alternatives provide equivalent functions, a comparison is sensible. For some users, 1-liter and 2-liter bottles are functionally equivalent.

First, a choice has to be made on the comparable alternatives. In some cases it may be useful to compare two packaging systems for coffee milk: the 1-liter bottle versus the individual portions of 10 ml in plastic cups. This exercise will be completely uninteresting for a consumer who only rarely uses coffee milk, but for daily use by a family, this is really interesting. They have to choose between the two systems and might want to use environmental information in their decision along with other aspects related to consumer preference, such as convenience and cost. The user eventually makes an overall evaluation of different aspects, such as cost and convenience, judges what he finds most important, and decides. LCA thus tries to provide information on the environmental aspects only.

Towards a Sensible Environmental Assessment

It is clear that consumers, from single households to professional organizations, make purchase decisions. Protection of the environment demands that environmental considerations play a role in this decision-making process. This begins with the question of whether the product is really needed (do I really need food?), whether another product is preferable (do I really need peas for food?), which form is best (do I

really need retort-conserved peas for food?), which package is best (do I really need retort-conserved peas in glass for food?), and ends with a choice of packaging size (do I really need retort-conserved peas in 1-liter glass jars for food?). Aspects that could subsequently enter the analysis are the amount of food spilt by adhesion or by going bad. Investigating consumer behavior in this respect, thereby making a distinction between the average consumer, small families, large families, canteens, etc., can improve the value of LCA and can increase the environmental gain that can be attained.

Acknowledgments

We thank Prof. Dr. Helias A. Udo de Haes for helping to clarify our arguments. The comments of two referees were used to improve the paper as well.

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