

Environmental impacts of food purchases investigated in a modular LCA

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Abstract

The environmental impacts caused by different types of consumers while purchasing food products were investigated in a diary study and assessed with a modular LCA approach. This research shows, in collaboration with a group of psychologists, the ecological, economic, and cognitive restrictions and options for an ecological orientation of food purchases. The extent of environmental impacts of food purchases depends on various factors, for example, agricultural technique, transport distance, packaging or the consumption phase. It is not easy for consumers or even for experts to account for these impacts. The analysis made it possible to show the influence of different product characteristics within the total environmental impact of meat and vegetable purchases. The predicted more ecological types of consumers caused lower environmental impacts than the so-called „anti-ecologists“. The life-cycle-inventory considers all environmental impacts related to a particular consumer decision. The environmental impacts are evaluated with the new Eco-indicator 99. This simplified LCA method allows investigating the trade-offs among different decision characteristics. It can be shown that most of the decision parameters, such as origin, production method, type of conservation, might have an influence on the overall impacts of a vegetable product. Greenhouse production and products transported by air cause the highest surplus environmental impact. The agricultural production determines the overall environmental impacts for meat products.

Keywords: environmental behaviour; food consumption; meat; simplified LCA; vegetables

I. Goal and Scope.

The extent of environmental impacts of food products depends on various factors, e.g., agricultural technique, transport distance or packaging. It is not easy for consumers or even for experts to account for these impacts. The environmental impacts caused by different types of consumers while purchasing food products were investigated in a diary study and assessed with a modular LCA approach. This transdisciplinary research work aimed to show, in collaboration with a group of psychologists, the ecological, economic, and cognitive restrictions and options for an ecological orientation of food purchases (MAIER & JUNGBLUTH 2000).

II. Methods.

Different factors influencing the importance of environmental impacts have been identified for the life cycle of food products (JUNGBLUTH *et al.* 2000). They are shown in Tab. 1. The consumers can recognise these impacts by considering certain product characteristics corresponding to the determinants of environmental impacts.

Tab.1 Determinants of environmental impacts for decisions making levels considered in this study. Corresponding product characteristics for food products and the peculiarities investigated for these characteristics.

Determinants of environmental impacts	Corresponding product characteristics	Peculiarities of the characteristics
Type of product and agricultural practice : (e.g. organic or greenhouse production).	Product label, season, origin, and product category.	Meat or vegetable from greenhouse, organic or other production.
Processing in food industry and distribution of the product.	Type of conservation.	Fresh, chilled, deep-frozen or pasteurised.
Distance and mode of transportation .	Country or area of origin.	Region Berne, Switzerland, Europe, overseas.
Type and amount of packaging materials .	Material of the packaging.	Cardboard, glass, metal, paper, plastic, Styropor.
Cooling, cooking, etc. during consumption .	Depending on the type of conservation (and household behaviour).	Fresh, chilled, deep-frozen or pasteurised.

Various combinations of the product characteristics are possible when a consumer looks for a food product in a shop. In order to simplify the analysis a modular LCA approach has been developed (Fig. 1). The inventory for various food products is split into five modules according to the product characteristics. An LCI has been elaborated according to the possible product characteristics of these modules (JUNGBLUTH 2000).

Single life cycle inventories for the different peculiarities of the five characteristics can be combined in order to assess the total burden of a purchased product. The analysis made it possible to show the influence of different product characteristics within the total environmental impact of meat and vegetable purchases. The life-cycle-inventory considers all environmental impacts related to a particular consumer decision.

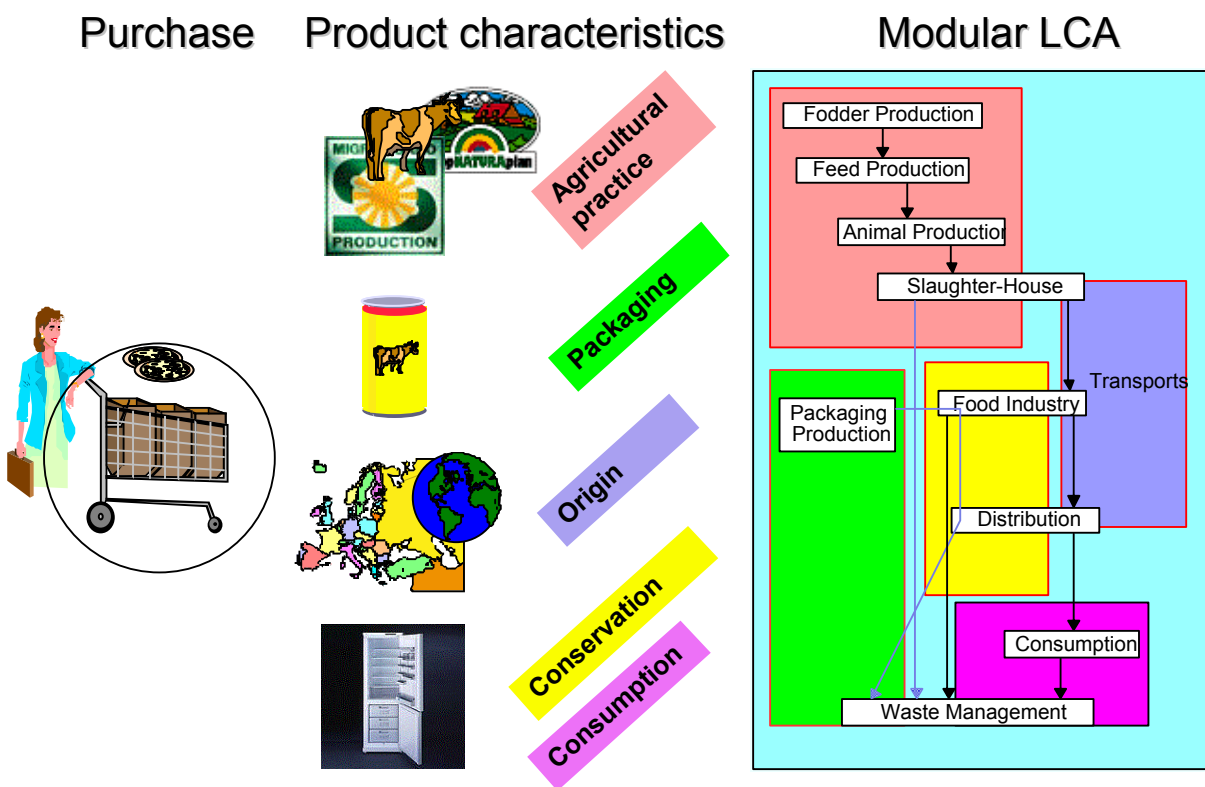


Fig. 1 Product characteristics and the corresponding modular LCA.

III. Results and Conclusions.

The simplified modular LCA method allows investigating the trade-offs among different decision characteristics. Eco-indicator 99 has been chosen to assess the environmental impacts with a single-score method (GOEDKOOP & SPRIENSMA 2000, JUNGBLUTH & FRISCHKNECHT 2000). Fig. 2 shows the scores (Hierachist) for the modules investigated. The agricultural production determines the overall environmental impacts for meat products. The differences in environmental impacts highlight the possibilities for environmentally sound purchases of meat. It can be shown that most of the decision parameters, such as origin, production method, type of conservation, might have an influence on the overall impacts of a vegetable product.

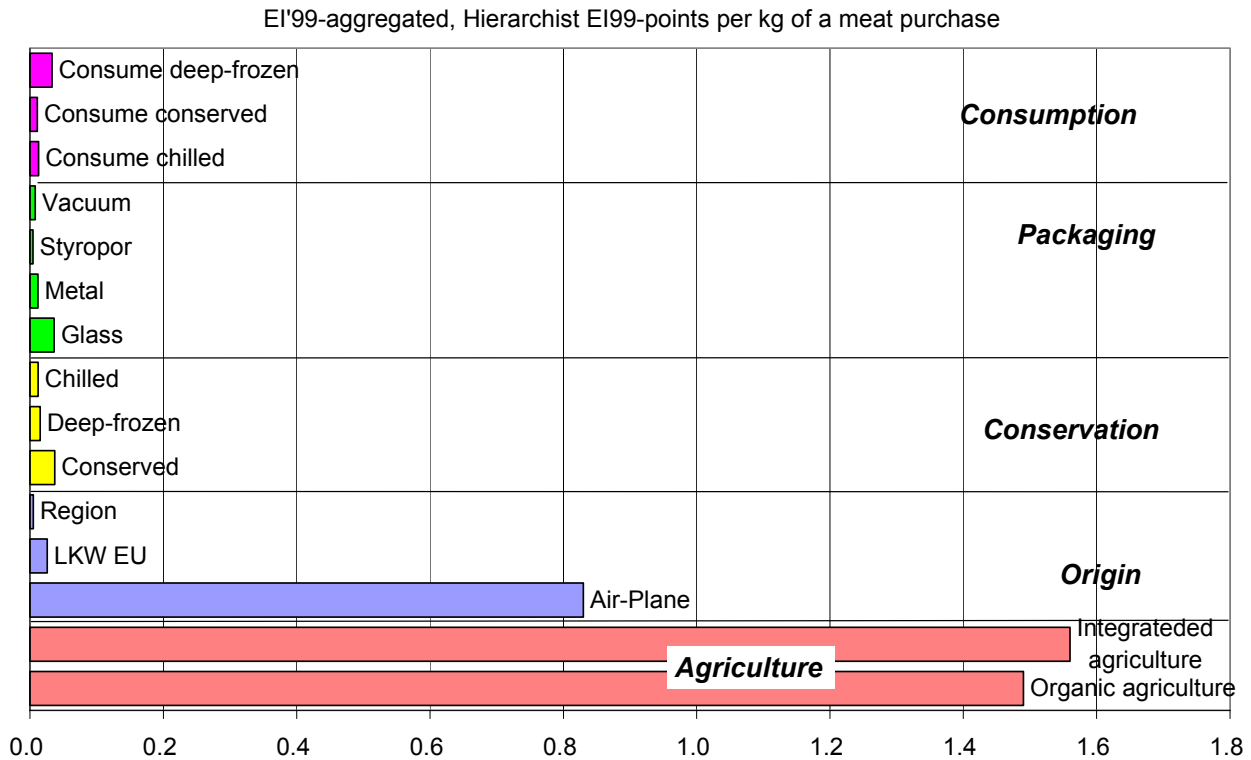


Fig. 2 Eco-indicator 99 points for different characteristics of meat products.

An average purchase of meat, of vegetables, or of both groups together has been chosen as the functional unit to compare the environmental impacts due to different consumption patterns. Fig. 3 shows the impacts for these consumer subgroups expressed in Eco-indicator 95+ points. The Eco-indicator 95+ is a method to summarise all environmental impacts to one single indicator (Goedkoop 1995). The scale for vegetable purchases is on the left side, the one for the total average of meat and vegetable buying on the right side.

Persons belonging to different subgroups do definitely differ with regard to the environmental impacts caused by their purchases. The values of Eco-indicator 95+ points decrease from the consumer type called "anti-ecologist" to the one named "ecologist". The comparison shows the predicted environmentally sounder behaviour of those consumers which tend to take the environment more serious, which have more knowledge, and which use environmentally sounder distribution channels. These consumers considered all the product characteristics and bought those products to a larger extent with the less polluting peculiarities. But, the detailed analysis reveals some constraints on environmentally sound behaviour.

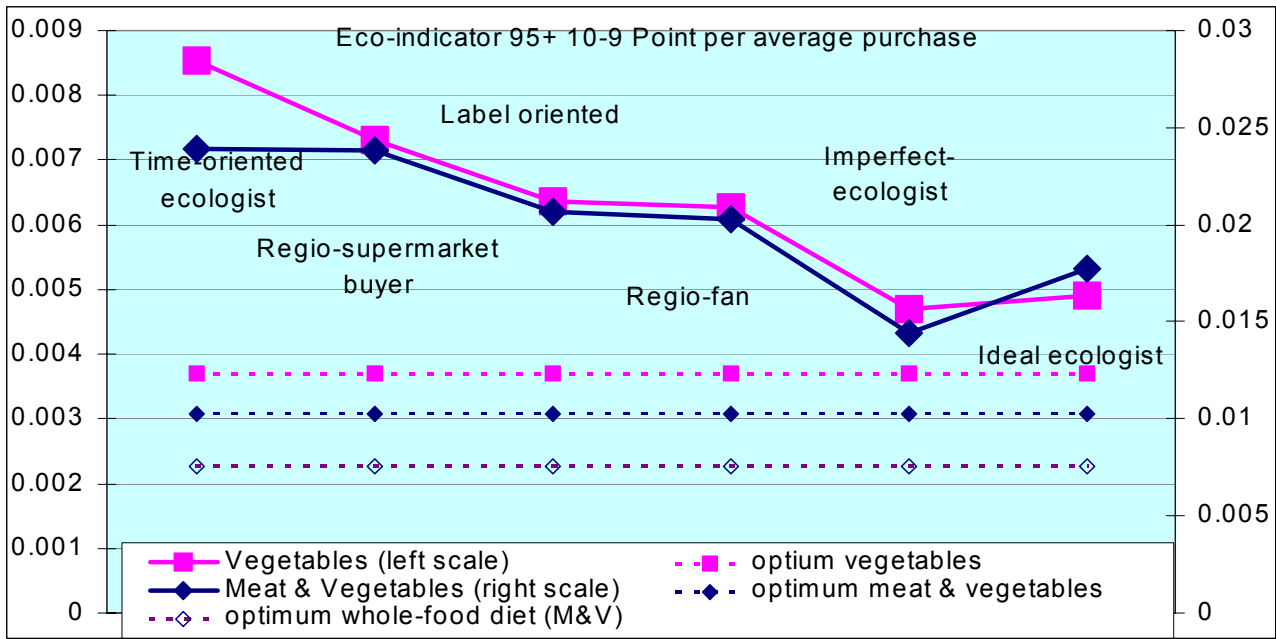


Fig. 3: Eco-indicator 95+ points for an average purchase of different consumer subgroups.

Members of the subgroup that is short of time only look at product labels and thus sometimes buy the environmentally more polluting products. Integrated labelling for transport and open air production would be helpful for these time-oriented persons. It is surprising that the impacts of an average purchase for the "ideal ecologist" are a little bit higher than for the "ecologist". This is due to the higher amount of meat products purchased by this subgroup even though these consumers buy meat with an ecological label to a larger extent than these from other groups. This type of consumer may switch to a more vegetarian diet in order to reduce the environmental impact.

IV. Recommendations and Outlook.

The method allows to investigate a range of similar products in a simplified approach. It might also be used for other examples of environmental decision making were a range of product choices has to be modelled. The method helps to identify options of environmental sound behaviour for consumers.

Consumers can adapt their behaviour and buy more of the environmentally friendly products. Starting from the average purchases investigated in a diary study (ARNOLD *et al.* 1999), different options for these changes have been compared. Fig. 4 gives the increase or decrease of environmental impacts that result from a 1% increase of the indicated peculiarity of a characteristic. The change in environmental impacts resulting from a marginal change of purchasing patterns helps to rank different recommendations for consumers. Greenhouse production and products transported by air cause the highest surplus environmental impact if marginal changes of consumption patterns are evaluated.

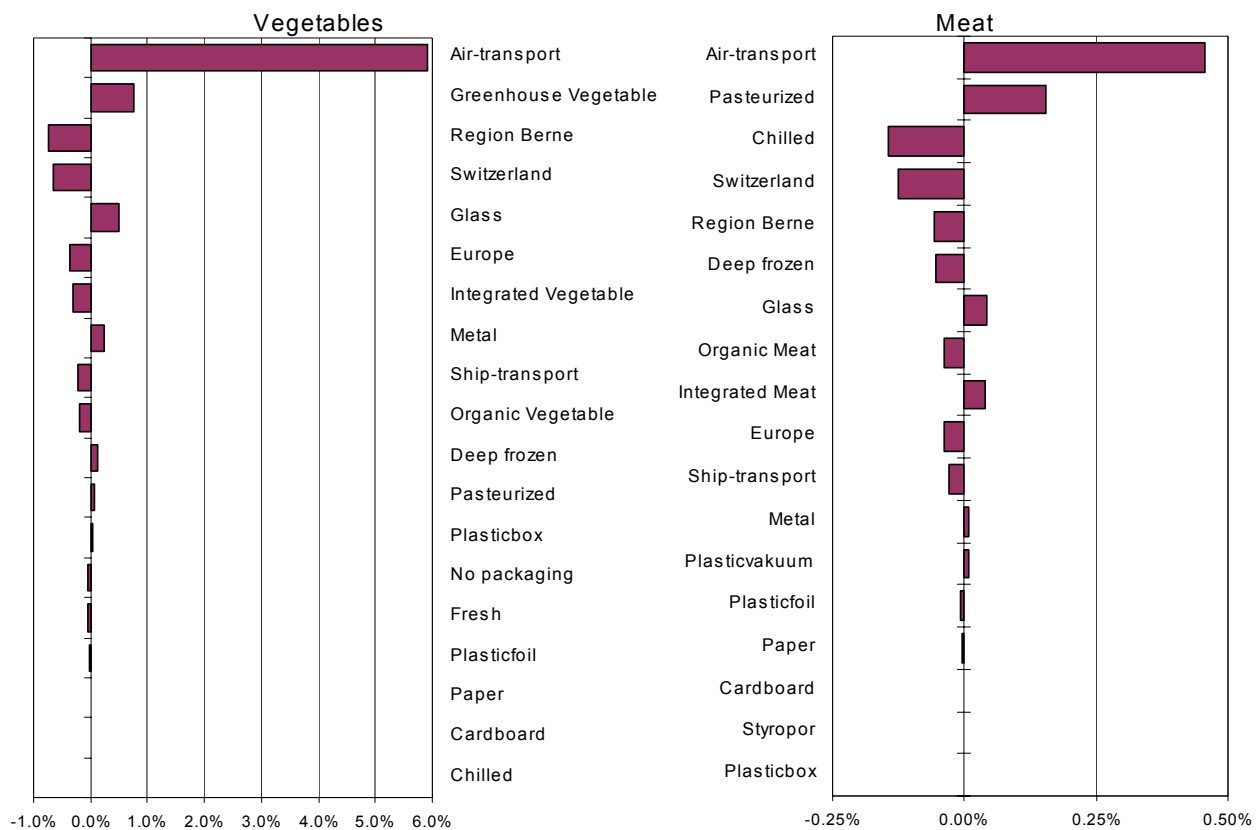


Fig. 4 Change of environmental impacts for food purchases due to a marginal change (1-percentage increase) in the purchase of the products exhibiting the peculiarity shown. Consumers reduce the environmental impacts of their purchases if they buy more products with these peculiarities whose bar point to the left.

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