

Analysing tradeoffs between social and other dimensions of sustainability in LCA

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1. Introduction

Traditionally, main focus in LCA has been to evaluate environmental impacts of products and services.

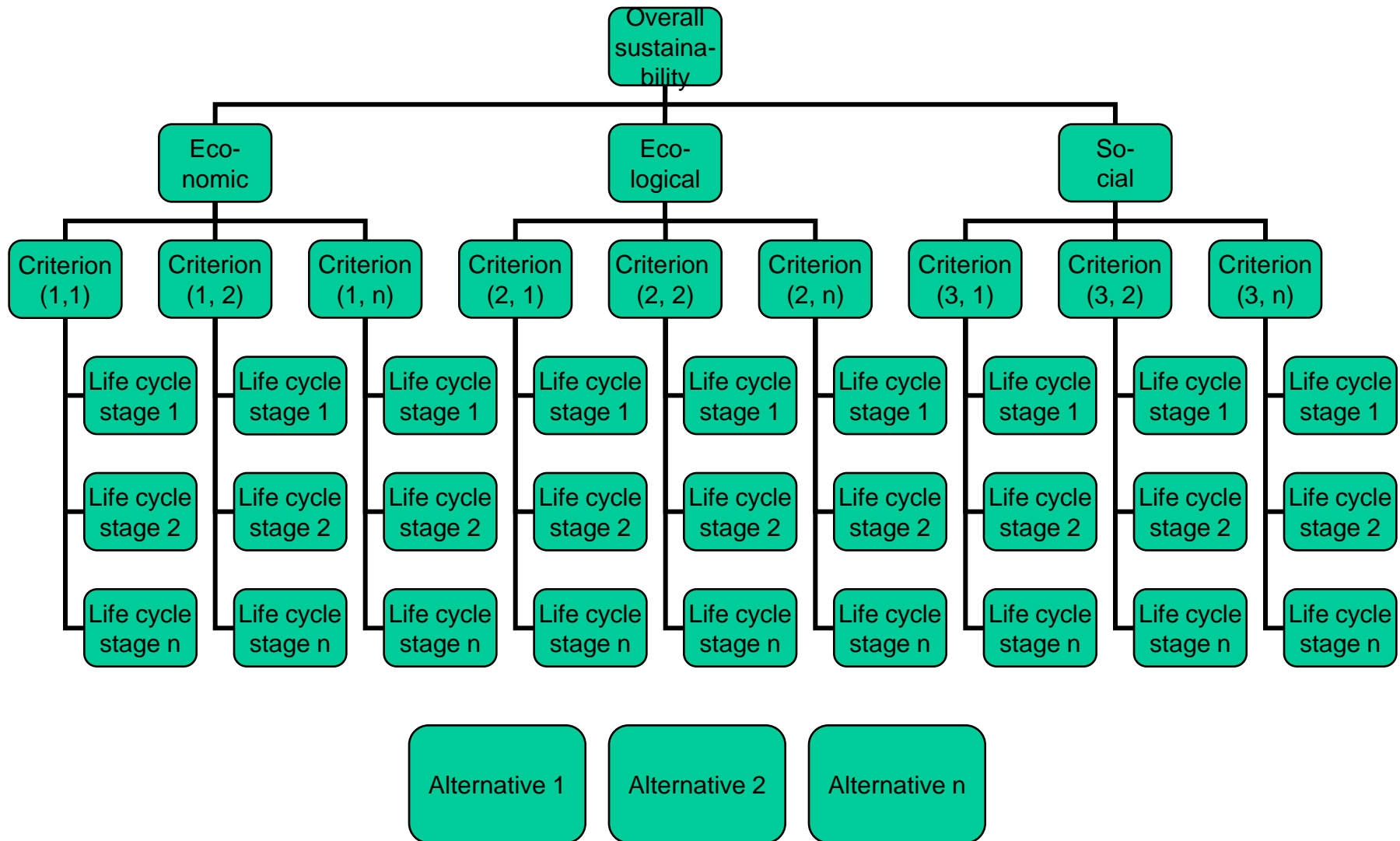
Nowadays, also other dimensions of sustainability has been received more and more attention:

- Economical sustainability.
- Social sustainability.
- Even cultural sustainability.
- ...

In conscious decision making, decision makers should take into account all dimensions of sustainability simultaneously:

- Usually e.g. ecologically most beneficial alternative is not most optimal with respect to other dimensions.
- > Analysis of trade-offs between different dimensions of sustainability.
- > **Combination of LCA and MCDA** (multi-criteria decision analysis).

2. General framework for LCA and MCDA



Principle in combining LCA and MCDA:

- A standard MCDA-model, but decision alternatives are production chains.
- A standard LCA-model, but multiple dimensions of sustainability.

Tradeoffs are the key interest in MCDA:

“How large economic disadvantage you are willing to accept to achieve certain social or ecological benefit?”

In MCDA, the solution is to construct a theoretical utility (or value, or priority) scale.

Note that different dimensions/indicators are usually measured at different units so that they are not directly commensurable.

Cardinal utility scale so that the analysis of the tradeoffs is possible:

- Interval scale models (e.g. MAUT).
- Ratio scale models (e.g. AHP).

Framing the decision problem:

A central idea is to create a model in which certain specific decision alternatives are compared.

Usually a discrete choice model that consists of relatively small number of decision alternatives (e.g. 3-10).

In the case of a discrete choice model, the aim is to create a model that enables to find an optimal decision alternative, not just to measure sustainability in general.

- This will pose some requirements for the model (discussed later).

Case by case analysis:

- Decision alternatives should be defined explicitly stemming from the decision problem.
- The same goes with utilised dimensions of sustainability and decision criteria/indicators.
- E.g. regionally specified production chains.

3. Viewpoints to measure social impacts in the framework

In MCDA, the focus is to analyse the tradeoffs between decision criteria:

- This implies that also the social impacts should be measured coherently to the overall objective.

Some general properties of MCDA-model:

Independence of decision criteria / indicators:

- The collection of indicators should be preferentially independent, i.e. the performance of decision alternatives with respect to one indicator should be possible to assess independently of the performance with respect to other indicators.
- This assumption is often ignored.
- Problematic e.g. in the case of forest biodiversity (amount of old forests and deciduous trees, for example).
- How about social indicators?
- How about social vs. other dimensions of sustainability?

Overlapping / double counting between indicators:

- Should two slightly different viewpoints on the same issue be included in the MCDA model?
- Yes, if decision maker wants to take both viewpoints into account.
- E.g. employment and level of income.

Data sources in measuring social impacts:

Empirical data sets, national statistics etc. preferable, but perhaps not so well established as related to environmental impacts.

Need to utilise also other data sources such as modelling of expertise and stakeholders/participants subjective preferences.

- Decision analysis provides tools for this (see later in this presentation).

Need to take also uncertainties into account (i.e. the reliability of the data).

Challenge: data should be collected with respect to functional unit.

4. Problem structuring and preference rating techniques

Two processes to define the indicators (in the BioSus-project):

a) Utilisation of available sustainability indicators (the case of social sustainability):

- Select experts and ask them to evaluate the relevance of the available indicators w.r.t. regionally specified production chains. Modify if necessary.
- Combine individually modified indicator lists and ask all experts to evaluate the relative importance of the indicators.
- Calculate e.g. means and deviations of the assessments.

b) No sustainability indicators available (the case of cultural sustainability):

- Select experts and ask them to produce ideas for indicators for regionally specified production chains by using Cognitive Mapping (CM; an example of a problem structuring technique).
- Combine individually produced lists and ask all experts to evaluate the relative importance of the indicators.
- Calculate e.g. means and deviations of the assessments.

Preference rating techniques:

Why needed:

- In addition to characterisation and normalisation in LCA, also weighting is needed for estimating the overall impacts of production that take into account all indicators and all dimensions of sustainability.
- Weighing is subjective by nature and requires specifically designed techniques.
- Expert judgments, decision makers' / stakeholders preferences.
- Applicable also in the phase of impact assessments, not only with weighting.

Different tools (cardinal models preferred due to tradeoffs), e.g:

- Simple Multiattribute Rating Technique (**SMART**): select the most important indicator, assume that it has 100 points and evaluate other indicators with respect to the most important one (many modifications available).
- Pairwise comparisons (as applied in the Analytic Hierarchy Process **AHP**): compare the relative values of indicators pairwise, i.e. one pair at a time.

5. Discussion

Analysing social impacts in LCA is not that well established compared to environmental LCA:

- > need for new research work.
- > also applications of different **rating** techniques when assessing social impacts: modelling of expertise and stakeholders' / participants' subjective preferences.

Important to remember the viewpoint of decision making:

- Social impacts should be evaluated against other dimensions of sustainability
- > application of **MCD**A-models.
- > application of **weighting**/rating techniques.

Take local conditions and the studied case into account:

- Define sustainability indicators explicitly with respect to local conditions and production chains.
- > Application of **problem structuring** techniques.