Additional information about Life-cycle assessment

Life-cycle assessment (LCA, also known as life-cycle analysis, and cradle-to-grave analysis) is a method that enables to consider the environmental impacts associated with all the stages of a product's life. The term *life cycle* evokes/involves an holistic approach that requires the assessment of raw-material production, manufacture, distribution and disposal, including all the necessary transportation steps (Fig.1).

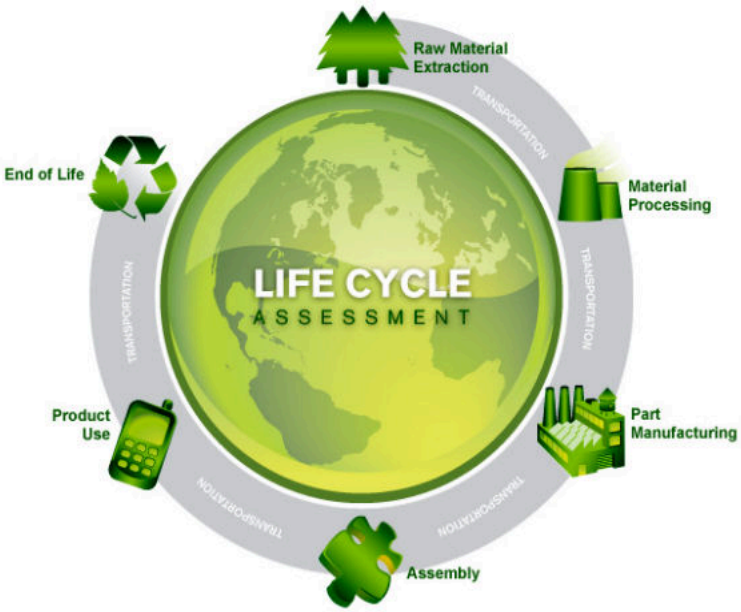

Fig.1. The scheme of a general Life Cycle Assessment

The importance of this method is mainly in its innovative approach, considering all the stages of a production process as linked and interrelated.

LCAs can be useful to develop a global outlook on environmental concerns and effects related to products and services. It enables to quantify all relevant emissions and resources consumed, together with the related environmental and health impacts and resource depletion issues associated with any goods or services (“products”).

Life Cycle analysis, in other words, enables to explicit an inventory of flows from and to nature for a product system. These flows include inputs of water, energy and raw materials, and releases to air, land and water. They are drawn by constructing a flow

model, using data on inputs and output (Fig.2). This phase is followed by impact assessment, aimed at evaluating the significance of potential environmental impacts.

The results from the inventory analysis and impact assessment are summarized during the interpretation phase, whose result is a set of conclusions and recommendations for the study (Fig.2).

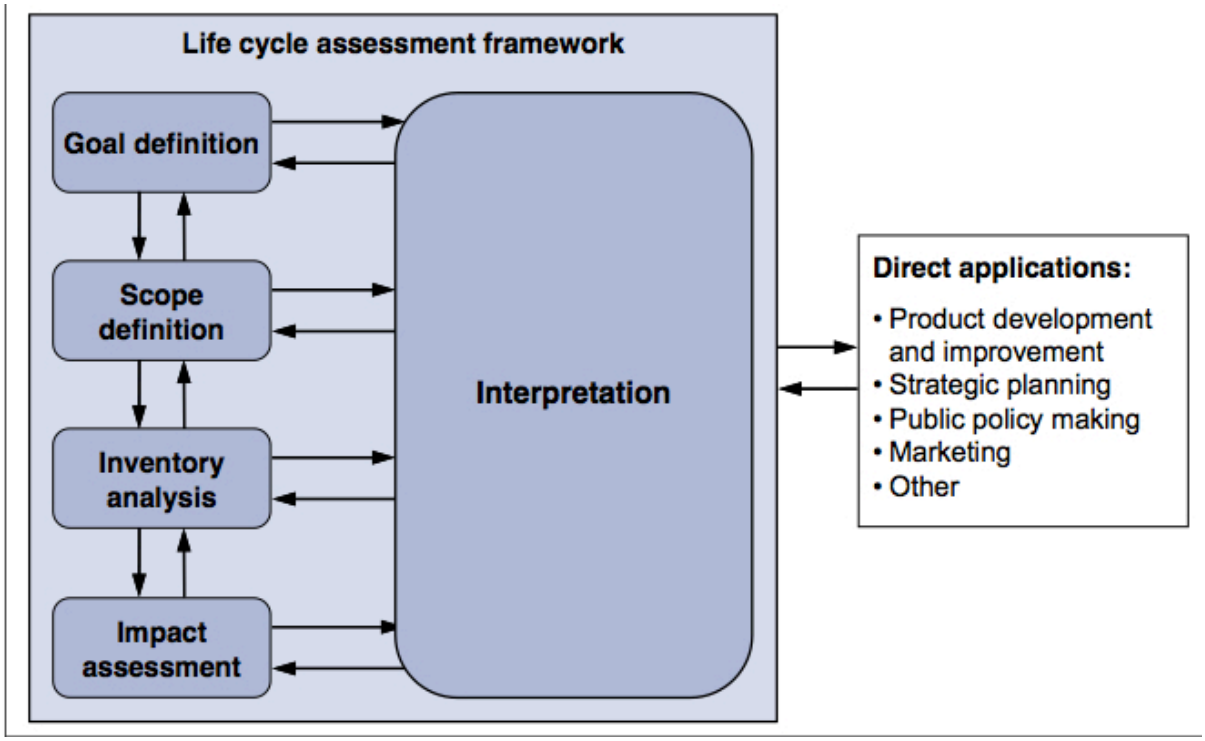

Figure 2. Framework for LCA (from: European Commission, 2010)

The procedures of life cycle assessment (LCA) have been defined at an international level, by ISO 14040 and ISO 14044 environmental management standards.

LCA provides a sound basis for informed decisions and consequently, has major roles in environmental impact assessment, integrated waste management and pollution studies. In addition, it's very often used to support business strategy and Research &Development, as input to product or process design, in education and for labelling or product declarations. Life Cycle Assessment is therefore a powerful tool for decisions (complementing other methods).

In order to get a 'whole picture' of a product, however, it is vital to extend current life cycle thinking to encompass all three pillars of sustainability: (a) environmental, (b) economic and (c) social. The life cycle of a product, in fact, involves not only flows of material and

energy but also money, so the picture is not complete unless the production and consumption impacts on all actors along the 'value chain' (workers, local communities, consumers and society itself) are included.

To consider these issues, different life cycle assessment techniques have been developed:

- an (Environmental) life cycle assessment (LCA); it looks at potential impacts to the environment as a result of the extraction of resources, transportation, production, use, recycling and discarding of products;
- a life cycle costing (LCC); it assesses the cost implications of the environmental life cycle;
- a social life cycle assessment (S-LCA); it examines the social consequences of the process.

The interrelationships of the above tools, allow individuals and enterprises to assess the impacts of their purchasing decisions and production methods, giving form to an overarching idea of life cycle assessment, named life cycle sustainability assessment (LCSA).

In this context, understanding, quantifying and communicating the sustainability of products is seen as part of the continuous reduction of impacts and increasing of benefits to society.

Potential and future decision-makers, stakeholders, enterprises and consumers (Fig.3) can benefit from LCSA in different ways (UNEP/SETAC, 2011). LCSA, for example:

- enables practitioners to organize complex environmental, economic and social information and data in a structured form;
- shows enterprises how to become more responsible for their business by taking into account all the impacts associated with their products and services;
- helps in clarifying the trade-offs between the three sustainability pillars, by providing a more comprehensive picture of the positive and negative impacts along the product life cycle;
- promotes awareness in value chain actors on sustainability issues;
- supports decision-makers in prioritizing resources and investing them where there are more chances of positive impacts and less chance of negative ones;

- stimulates innovation in enterprises and value chain actors.

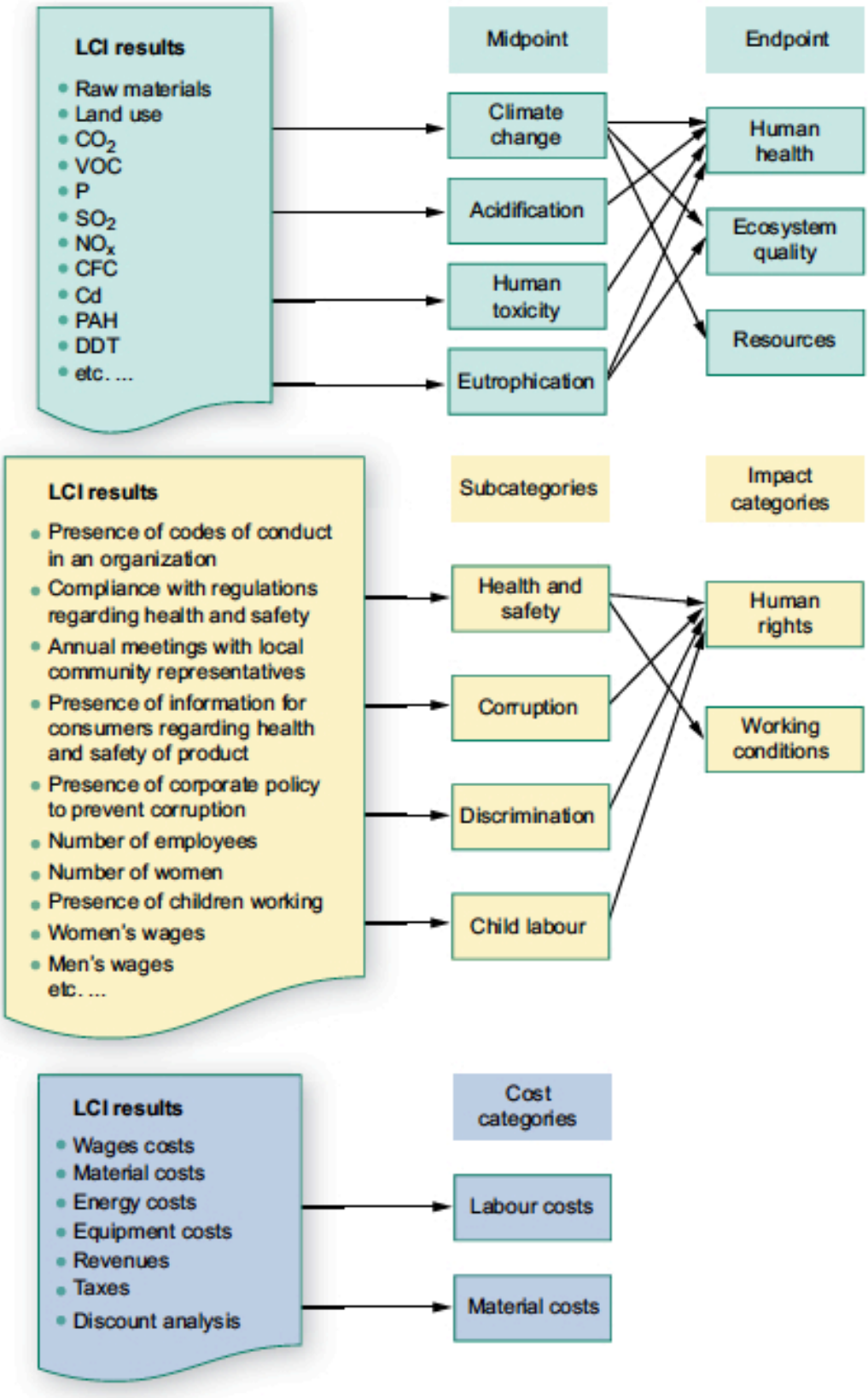

Fig.3. Examples of categories involved in a life cycle sustainability assessment (LCSA) (from: UNEP/SETAC/Life Cycle Initiative).

Finally, applying the *life cycle thinking* (also called the life cycle perspective) to the pillars of sustainability, offers a way of incorporating sustainability in school within teaching and learning activities, going *beyond* the more narrow traditional and strictly disciplinary focus and approach. Starting from these considerations, this approach has been considered and used within Sustain project.

References

European Commission - Joint Research Centre - Institute for Environment and Sustainability, International Reference Life Cycle Data System (ILCD) Handbook - *General guide for Life Cycle Assessment - Detailed guidance*. First edition March 2010.EUR 24708 EN. Luxembourg. Publications Office of the European Union; 2010.

UNEP/SETAC/Life Cycle Initiative, *Towards a Life Cycle Sustainability Assessment: Making informed choices on products*, Nairobi, Kenya, 2011.