EcodEX: A simplified ecodesign tool to improve the environmental performance of product development in the food industry

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ABSTRACT

Nestlé has engaged in the development of a simplified ecodesign tool (EcodEX) for the assessment of products in the development process. EcodEX guides the user along the predefined phases of the life cycle of a typical food product, using a preselected list of life cycle inventory data. The tool is currently being used by a user base of non-LCA-specialists that have been provided with a basic training on the tool use, as well as with basic understanding of sustainability in the food sector. First results indicate that the tool can improve the design of new products and plays a very important role in increasing the understanding of sustainability in the organization. Key challenges are the availability of life cycle inventory data and the training and support process for a large user base.

Keywords: product development, innovation process, ecodesign, simplified LCA,

1. Introduction

Nestlé, the world's leading Nutrition, Health and Wellness Company, has integrated the life cycle approach into its innovation and renovation processes to improve the environmental performance of new food products under development. Over the past years, Nestlé has done life cycle assessments (LCAs) for representative products in each of its business categories, and has summarized and shared them internally using Sustainability Category Profiles. Some of these studies have also been published (Humbert et al, 2009a; Humbert et al, 2009b). While these studies give valuable insight for strategy setting of businesses, the conventional life cycle assessment approach is impractical for widespread application in product development. A company as large and diverse as Nestlé, with thousands of new product developments every year, would have to deploy a considerable amount of resources on these assessments. Furthermore, given the speed at which innovation occurs in the fast moving consumer goods sector, and in particular in the food industry, results from conventional LCA studies will, in many cases, become available only once the Nestlé Product Development Process has advanced significantly (see figure 1 below). Therefore, a simplified, yet reliable, ecodesign tool specific for the assessment of food and beverage products has been developed and rolled-out in Nestlé R&D over the last years. This paper presents the outcomes of this roll-out and assesses the benefits of such an approach for large food companies.

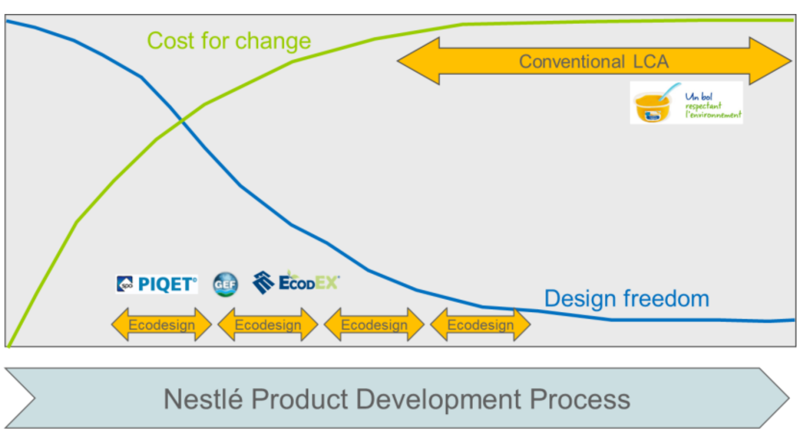

Figure 1. Nestlé Product Development Process and the positioning of conventional LCA (top right) vs. simplified ecodesign tools, which apply the LCA methodology earlier in the design process to optimize their influence on product development.

2. Methods

2.1. Goal and scope definition

EcodEX is a simplified ecodesign tool that guides the non-expert user through the different stages of the life cycle of a typical food product, providing him/her with a reliable estimate of the environmental hotspots in the products value chain, as well as a comparison of the environmental performance of different design alternatives (Selerant 2014). As compared to conventional LCA software, EcodEX has a significantly reduced flexibility in what can be modelled with the tool: the user is guided across the typical life cycle of a food product (ingredients, packaging, processing, distribution, consumer use, and end of life) and can enter only the data appropriate for these life cycle phases. The user mostly selects LCI (life cycle inventory) profiles from a pre-defined list without the possibility of modifying them. In the case of processing, though, default values for electricity, heat, and water consumption may be overwritten with measured factory data.

The tool is linked to the Nestlé recipe management system, extracting high quality data on recipe composition and processing steps directly from an existing IT system. Ingredient specifications in the food industry can easily run into tens of thousands, turning their management into a complex endeavor. This is why a key requirement in the development of the tool was the link to the management system already in place at Nestlé.

2.2. Inventory data

The recipe management data and information entered by the user (e.g. mode of transportation and distance travelled) are then combined with inventory data. The majority of LCI data comes from public data sources, in order to ensure the credibility of the results of the tool. Major databases used in EcodEX are Ecoinvent 2.2 (Frischknecht et al, 2005) (for electricity profiles, transportation, as well as packaging materials), and the World Food LCA Database (Quantis, 2014) (for food ingredients). Also, the Agribalyse database (ADEME, 2014) may be used in the future for additional food ingredients. Some ingredients where no datasets are currently available in public databases have been created based on LCA studies done by consultants for Nestlé. Datasets on novel food ingredients or packaging materials may also come from suppliers.

2.3. Impact assessment methods

The tool calculates environmental impacts according to internationally harmonized LCA methods, such as the ISO 14040 & 14044 norms (ISO 2006a, ISO 2006b), the European Union Product Environmental Footprint (PEF) (EC 2012), and the EU Food Sustainable Consumption and Production Roundtable ENVIFOOD protocol (Food SCP RT 2013). Currently, five environmental impact indicators are taken into account by EcodEX: land occupation and water consumption at the inventory level; GHG emissions at a 100 year perspective (IPCC 2007) and Non-renewable minerals and fuels (CML 2014) at the midpoint level; and Ecosystems Quality (based on the IMPACT 2002+ method and modified to exclude land occupation and thus avoid double counting) at the endpoint level (Jolliet et al, 2003).

In addition to the exclusion of land occupation in Ecosystems Quality, the ecotoxicity characterization factors of metal emissions in agriculture have been set to zero. This is because the modeling of metal toxicity in IMPACT2002+ is deemed insufficiently accurate to be taken into account in a simplified ecodesign tool for the agri-food sector. For instance, the impacts of copper used in coffee and cocoa production (application rates of copper pesticides are well below the levels authorized per hectare in organic agriculture for many crops in Europe) result in toxic effects several orders of magnitude above those of “problematic” conventional pesticides such as Aldicarb that are also used in coffee and cocoa production.

2.4. Interpretation

A consequence of the development and application of a simplified ecodesign tool is the introduction of larger uncertainty in the results of the assessments. Therefore, EcodEX is not intended for communication purposes, but for internal decision making only. Work is currently ongoing to develop a specific module to assess uncertainties in a reliable way directly as part of and EcodEX assessment.

3. Results

EcodEX has been regularly used by the Nestlé R&D community for approximately one year now. There are around 100 users of the tool, and approximately 900 LCA scenarios have been calculated in this period. The results of these scenarios have influenced the development process of new products in several ways:

If the environmental performance of the new design worsens:

- Product designers may work on an alternative design that improves the environmental performance of the product. In the past, in the absence of EcodEX, designers were not aware that their designs had worsening impacts for the environment.
- The product development may be interrupted or stopped altogether because environmental performance is of key importance to the business unit and market. Without the information provided by EcodEX, decision makers are not in the position to take timely decisions at the earlier stages of the development process. In case an LCA study was commissioned to an external consultant, the conclusions would become available too late in the design process.
- A decision may be taken where the project goes ahead despite the adverse environmental effects, because of other criteria such as consumer preference, nutrition, quality or legal requirements. In this case, EcodEX did not have any tangible consequence for the environment. However, decision makers will be aware that they are launching a product with higher environmental impacts, and will need to be able to defend their decision e.g. against critical consumers or NGOs.

If the environmental performance of the new design improves, the results can be shared internally to gain support for the new product development. This may result in a faster adoption of the product, or the use of the product in other markets.

In addition to these direct benefits on the product development, the tool has also very strongly increased the understanding on food environmental performance among the users: product developers that calculate the environmental performance themselves get a much deeper understanding of their product life cycle than those who are presented with a report and finalized results. For instance, everybody knows intuitively that meat products have higher environmental impacts than plant-based alternatives. However, if the product developer is able to calculate the difference himself, the actions prompted will be larger and further reaching because the product developer fully engages with the assessment.

4. Discussion

A number of challenges have occurred during the development and implementation of EcodEX:

4.1. Inventory data

For such a tool to be applicable, high quality LCI data for an extensive array of food ingredients used in the food industry are required. This is currently being addressed by a number of initiatives, such as the World Food LCA Database Project (reference). Currently, LCI profiles are available for the majority of key ingredients, but too specific profiles are often not representative of general conditions (e.g. tomato, organic production, Switzerland vs. tomato, global average). First of all, ingredient data representing global averages should be developed. Over time, the amount of data will increase, and will allow the assessment of more specific ingredients (e.g. stevia vs. artificial sweetener), ingredients from specific regions grown under specific climatic conditions (e.g. wheat from Southern Spain vs. wheat from the Nebraska, US), and different cultivation practices (e.g. integrated pest control vs. conventional production).

4.2. Training

Users have to be extensively trained to gain the appropriate understanding on sustainability and life cycle assessment, which inevitably requires time and significant resources. Most users have a background in nutrition, food science, process engineering, or packaging technology, which provides them valuable insight in their focus area. In order to be able to make meaningful decisions on the environmental impacts of the products they develop, they need to expand their skills set to include this topic. It cannot be expected that the quality of the assessments is comparable to that of a trained LCA specialist at the beginning. Practice and frequent use of the tool, along with ongoing training through webinars (conference calls with desktop-sharing) and a review of the studies performed will assure that EcodEX users make high quality assessments over time.

4.3. Alignment with external initiatives

The importance of life cycle assessment for external communication is likely to increase in the future. While EcodEX is intended for internal decision making, EcodEX users will want to use the results for external communication as well. Therefore, it is important that the methodology in the tool is as closely aligned with externally developed methodologies as possible. This is not always a straightforward task, because external methodologies are subject to change and not all requirements are known in sufficient details.

5. Conclusion

Our experience shows that the use of simplified ecodesign tools can be very useful tool to improve the environmental performance of the products of a food company during their innovation and renovation process. In the future, the LCI data in the tool will be complemented with new profiles to make more specific assessments possible. The functionality of the tool will also be extended, in particular to accommodate a module that assesses uncertainty and significance of differences. This will further increase the usability of EcodEX and help improve decision making.

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