SUSTAIN: Increasing the Intelligence of Product Life Cycle Assessment Software

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Executive Summary of the SUSTAIN Project

The aim of Product Life Cycle Assessment (LCA) is to determine the impacts of a product on the environment. LCA is an important instrument in Design for the Environment. Life cycle assessment entails the specification of a model, comprising many different components, materials, energy, production, use and disposal processes, together with their varying environmental impacts, and with many interrelationships chaining all this together, see Figure 1.

by the Dutch Ministry of Economic Affairs SENTER-IT Programme as project nr. ITU95038. The objective was to develop a number of innovative ideas regarding product and process modelling that simplify the end user's task, and can be built into the SimaPro software package, the LCA software developed and marketed by PRé Consultants that is leading the market in Europe.

Deliverables. The project has produced three major deliverables, on interfacing Computer Aided Design (CAD) and LCA [Burghout, Akkermans, Borst, and Pos, 1997], on new methods for product dissassembly analysis [Borst and Akkermans, 1997], and on enhancements of LCA process modelling to make LCA software more intelligent and supportive [Warmer, 1997]. Some of the results of the SUSTAIN project have been reported at the SETAC Europe 1997 Meeting (Amsterdam, April 1997).

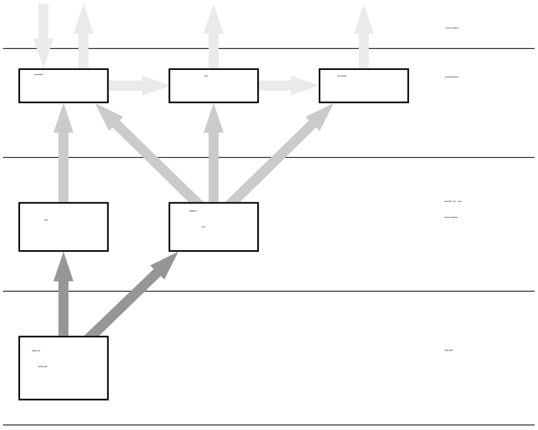

Figure 2: *Interfacing CAD and LCA.*

First, a study has been carried out on the possibilities of linking CAD to LCA [Burghout et al., 1997]. A feasibility study was performed to investigate automatic extraction of geometric information such as volumes and areas from CAD drawings for LCA purposes. Several CAD data interchange formats have been analyzed. It was concluded that only the ACIS SAT format can automatically provide some of the information desired for LCA purposes. Based on the requirements imposed by LCA and on the ACIS SAT data exchange format, a prototype CAD-LCA interface was designed, implemented and demonstrated (cf. Figure 2). Some further opportunities that should be researched were identified.

Improved modelling of processes is another important ingredient for better LCA information systems. This is the topic of the report by [Warmer, 1997]. It offers a number of practical improvements by introducing a much better structured notion of process, and by introducing a taxonomy of process types, cf. Figure 3. In this way, the system understands the inherent logic of processes and process types. This enables inheritance of information, performing automatic consistency checks, providing the user with default values and rules, informing the user about possible flaws, and automatically passing on relevant information along the chain. It amounts to the addition of a 'knowledge layer' to the standard LCA process model, assisting the analyst more intelligently during the construction of process definitions and trees.

Finally, a new technique for modelling product structure has been developed [Borst and Akkermans, 1997]. It enables automatic generation and assessment of product disassembly scenarios, cf. Figure 4. The technique is based on a formal typology and theory of component connections. An operational prototype system called PROMOD for this has been developed. In addition, this product modelling technique provides the framework for integrating the above-mentioned information from Computer-Aided Design drawings into LCA.

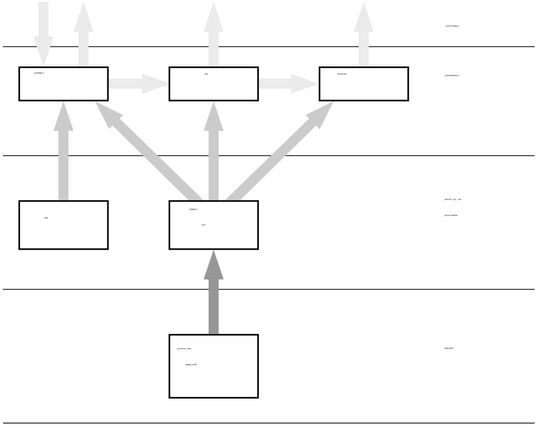

Figure 3: *LCA process modelling enhancements.*

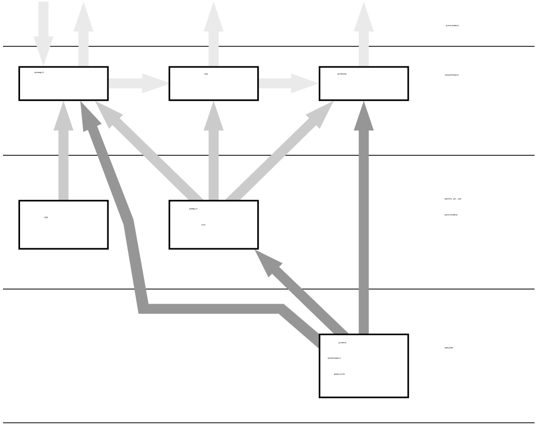

Figure 4: *Product disassembly analysis.*

Advances. In sum, the SUSTAIN project has delivered the following advances regarding Product Life Cycle Assessment (Figure 5):

1. An interface linking CAD with LCA software.
2. A new approach to product modelling, enabling automated disassembly analysis.
3. Enhanced process modelling, providing a more intelligent-acting LCA process editor and database.

It is planned to integrate and commercialize SUSTAIN results in a future version (5.0) of the SimaPro LCA software.

References: Project Deliverables

[1] W. Burghout, J.M. Akkermans, W.N. Borst and A. Pos:
Linking Computer Aided Design to Product Ecology Assessment,

Contract Report Senter-IT Project SUSTAIN (New Generation Software for Ecological Product Design), University of Twente and ECN, Enschede/Petten, NL, March 1997.

[2] W.N. Borst and J.M. Akkermans:
Disassembly Analysis for Product Life Cycle Assessment using the PROMOD *system*,
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[3] C.J. Warmer:
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Contract Report Senter-IT Project SUSTAIN (New Generation Software for Ecological Product Design), ECN, Petten, NL, April 1997.

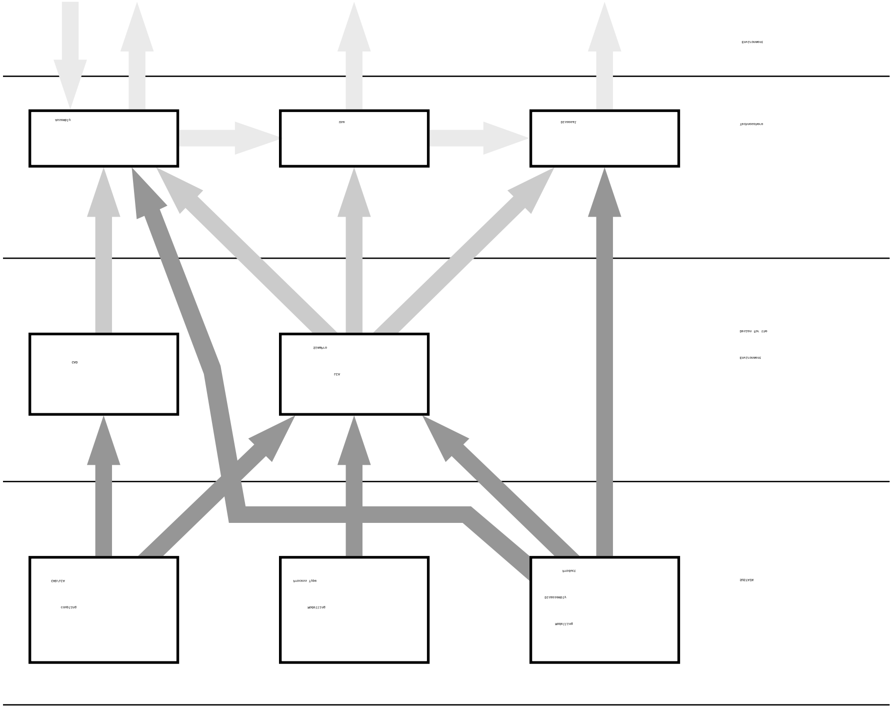

Figure 5: *Advances of the* SUSTAIN *project for Product Life Cycle Assessment.*