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Toward the design of a generic model of interoperability for Siec*

MENGQIANG YANG
Mail: mengqiang.yang@etud.univ-angers.fr

Abstract: Faced with the need to take into account environmental impacts, life cycle analysis (LCA) should emerge as an engine for innovation and eco-design. It is clear that there are many barriers to their deployment. There is thus a need for tools to facilitate their integration in business projects. These LCA tools must be compatible with different existing information systems. In addition, it is also necessary that the coupling of the different data sources helps to make decisions. This article shows the requirements of the company ACV Plus in terms of interoperability and HCI (Human-computer Interaction) in order to make its Siec software easily adaptable to various business sectors. Different peripheral tools have been developed to define data exchange formats and meet specific needs. Two PhD thesis have focused on the HCI aspects and on interoperability aspects. More generally, our project aims to develop a new system with interoperable design and management tools that can help any customer in the definition of its environmental projects and eco-design.

Key Words: *Decision support, interoperability, Life cycle assessment, Eco-Design, Human-Computer Interaction.*

Collaborations : Groupe ESEO, ACV Plus

1 INTRODUCTION

Several software systems have been proposed to compute life cycle analysis (LCA). They are listed on the website of the Institute for Environment and Sustainability, a joint Research Centre of the European Commission [1]. The main functionalities of these systems are usually restricted to the transformation of non-elementary flows to elementary flows in order to compute traditional basic environmental impacts. Moreover, these tools are mainly dedicated to environment specialists and they are still out of the reach of non-expert users for computing making decisions. This has very negative effects on the use and distribution of these systems. For example, the difficulties met by designers to use existing LCA tools have been identified by several authors [2, 3, 4, 5, 6] as a barrier to the use of these tools for eco-design. In fact, a study carried out in 2007 among a number of French companies and reported in [7] concluded that the failure of LCA to provide a real help in eco-design is one of the main reasons for which enterprises are reluctant in initiating eco-design practices. The above observations led us to think that to be of real use. LCA tools should go beyond this stage, be fully customizable and adaptable to business and domain specific issues by allowing the definition of goals, indicators, regulations, properties ... thus providing each department of the company with a specific and well suited view of the LCA. Finally, an LCA system should be able to be fully integrated in the company information system and be fully interoperable with its components: databases, Enterprise Resource Planning system (ERP), Computer Aided Design (CAD) tools, ... These ideas has led to the development of the SIEC system (SIEC is an acronym for "Système d'Information pour l'éco-Conception" meaning "Information System for Eco-Design" in French) [8].

The paper is organized as follows: In the second section, we describe all tools developed by our team, which will be used to collect data (provider information, selection of materials, add some specific module. We present their relationships with our SIEC system. Finally, we conclude and present some future work.

2 SIEC AND CURRENT PERIPHERAL TOOLS

Currently, SIEC is able to handle nearly all users' requirements such as the creation of products, their analysis, and so on.

However, this achievement is not the only purpose of SIEC, because other LCA tools may also provide the same functions.

ACV Plus wants to provide a better integration in the design processes, that's why a research project on interoperability has been launched.

On a complementary side, another team focuses on HCI (Human-computer Interaction) in order to insure that the three key features "Fast", "Simple", "Interactive" are fully integrated in the SIEC design.. The two teams collaborate because of their complementary objectives.

The SIEC system consists of a main software called Siec Genius and applications for different needs. We present now are some peripheral tools of SIEC:

2.1 CHRONOSIEC

CHRONOSIEC is a tool which facilitates to rapidly construct a full product with its providers. A user could also accomplish this activity in SIEC, but with the current technology in SIEC, the creation of the elements takes a lot of time. Moreover, the interface of creation is not intuitive.

However, with the help of CHRONOSIEC which adopts a recent technology, we provide the user with an intuitive interface. The user is able to create a product with its necessary elements, quickly and intuitively. Additionally, it is not necessary to connect to SIEC data center to use CHRONOSIEC, and a user is allowed to create a product independently and import this product into SIEC after having completed her/his project.

Figure 1 shows the functional model of CHRONOSIEC by providers.

Figure 1: Functional model of ChronoSiec.

Chronosiec is also a small application of 20Mo which contains many LCA databases (Eco-Invent, Buwal, LCA Food, Siec …) The user may also add lots of product elements. This allows all participants to use the same language and avoid mappings which are often long and tedious.

The construction of the data for each provider is intuitive by dragging boxes which are predefined (product, component, piece, material …) as showed in the following *figure (figure 2).*

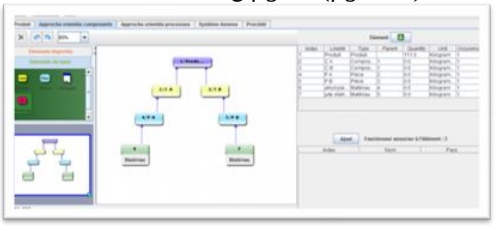

Figure 2: Interface of ChronoSiec

2.2 SIECMAT

SIECMAT is another independent tool which allows the user to choose among the materials according to certain requirements. A user could select the filtering conditions and import the preferred materials into SIEC after analysis.

This tool concerns more in material domain, it gives SIEC another function. Because not all users are interested in the material, this separated tool share a part of SIEC works so that SIEC is not too heavy for users. It has been developed by a strong collaboration between researchers of ACVPlus, Ecole des Arts et Métiers Paris Tech (ENSAM) and ESEO.

Unlike ChronoSiec, the application SiecMat allows computation in order to classify materials according to their performance.

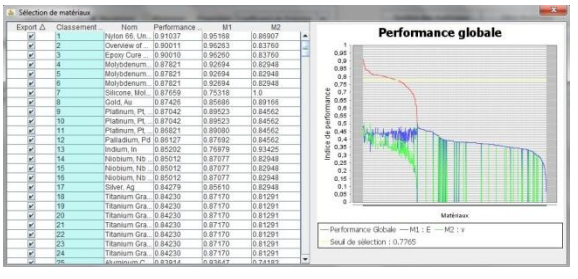

Figure 3: Material performance (Capture from SiecMat)

SiecMat is coupled to an American database “Mat Web” which contains more than 90 000 references and the database of CES EduPack.
After analyzing, the user can export these materials and compare then in Siec Genius in the environmental plan (Figure 5).

Figure 4: Functional model of SiecMat.

2.3 SIECTRANSFERT

Nowadays, there exist several LCA tools. Some of them, such as SIMAPRO, benefit from a ten years history on the market. Therefore, it is likely that some users are already working with other LCA tools before turning to SIEC. They may thus have important data collections that they do not want to lose either spend time to rebuild.
The SIECTRANSFERT tool enables the users to import data from these LCA tools into SIEC.
If someone used another LCA tool and wants change for SIEC, he will not lose any time to re-build the products that he already created. SIECTRANSFERT offers the facility to analyze the files of other LCA tools and generate a file using SIEC format, which will be processed in SIEC.
Figure 6 shows different steps to transform data from external tools to Siec Genius.

Figure 5: Functional model of SiecTransfert.

2.4 CAD Interoperability

In some industrial domains, CAD softwares such as AutoCAD, 3DXML Player are frequently used for project drawing purposes.
Thanks to the “Interoperability CAD” tool, SIEC is able to import files from these CAD softwares and generate directly a product with its associated elements as shown in figure 7.

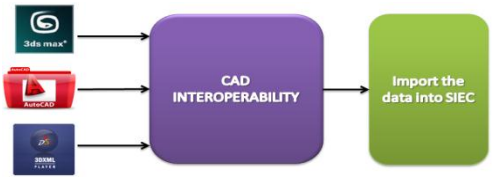

Figure 6: CAD interoperability components.

3 Conclusion

Actually, the peripheral tools work directly and independently with SIEC like SIECMAT, CHRONOSIEC, but the user has to download several tools if she/he wants to perform more than one activity. Moreover, there is no communication between these tools.
Thus, in order to insure communication and connection between these tools, ACV Plus is now searching for a solution in order to integrate the peripheral tools.

This diagram (figure 9) represents the current mechanism of the communication between SIEC and the peripheral tools. Each tool communicates directly with SIEC.

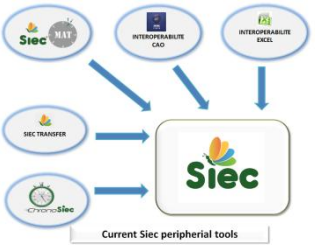

Figure 7: Communication mechanism between SIEC and the peripheral tools.

The purpose of ACV Plus is to integrate all these tools into one single package (figure 10). Each function may communicate and share information with others in this package. The communication between SIEC and these functions will be standardized and unified. In the near future, it will not be necessary to work independently with the peripheral tools thanks to the tools that will be integrated together.

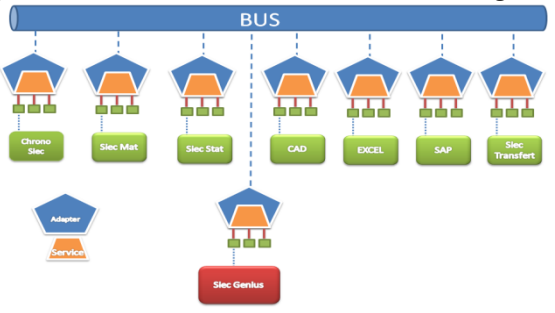

Figure 8: Proposal interoperability model between SIEC and the external tools.

In addition, the research focusing on HCI for Siec System is cooperated with ESSO [9] in order to have a better creation process for designing products and their elements as in ChronoSiec.

Conclusion

In this article the current Siec system and the communication procedure with peripheral tools have been briefly presented. In order to develop the system which achieves to the expectations of LCA experts, it is necessary to build a robust architecture in order to guarantee interoperability between Siec and external data source and tools. We have already started the implementation to connect Siec with existing CAD tools and ERP system. However, more analysis and experiments of different fields of activity, which may be useful to Siec, are still needed in order to identify the components and define generic models for integration.

Références (exemple)

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