Abstract

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Title

IT-supported evaluation of eco-efficiency potentials in chemical processes
discussion of experiences in the pharmaceutical industry

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Abstract
The concept of eco-efficiency was developed by the World Business Council for Sustainable Development (WBCSD) in 1992 and has become widely recognized by the business world. Eco-efficiency brings together the essential ingredients – economic and environmental progress – which are necessary for economic prosperity to increase with more efficient use of ressources and lower emissions.

This paper deals with a concept for an IT-supported evaluation of eco-efficiency potentials of chemical processes. Based on general concepts on the evaluation of eco-efficiency potentials from literature, procedures for their practical application in the chemical industry are discussed. One focus of the paper is the possibility of using IT-systems in order to model and assess material flows in chemical processes. This should be realised in a way, that material as well as cost related indicators could be calculated. As a practical application, the results from a project in the pharmaceutical industry are presented in detail.

In general, eco-efficiency describes the ratio between the product or service value and the environmental influence. In detail, the numerator is based on economical values like the volume of sales, the production costs or the marginal income combined with the added value. The environmental influence is combined with the total amount of material flows in association with their individual properties and effects. The assessment of environmental impacts combined with production processes is reached by the assessment methodology described in the international Guideline ISO14.042. Dealing with all those values requires a stepwise procedure combined with the usage of adequate instruments to evaluate the eco-efficiency.

The developed concept can be devided into four steps. As a first step, a scope and goal definition is done. This deals with the boundary conditions of the regarded object as well as the appropriate choice of economical and ecological indicators. Chosing transparent and verifiable indicators allows a meaningful interpretation to business managers and to external stakeholders. Measuring eco-efficiency basically requires – as a second step - the collection and examination of manufacturing data. Therefore, the material flow network approach combined with specific IT-systems assists to trace and analyse the material flows within a manufactur-

ing process. Furthermore, the pharmaceutical industry provides a profound knowledge concerning the process flow of active incredients. A detailed balancing of material flows is possible. Based on the gathered material and energy flows, an assignment of additional cost data is necessary (e.g. material costs, disposal costs, etc.). Depending on the chosen eco-efficiency-indicators, a third step towards the creation of economical and environmental performance figures can be realised. Therefore, the measured and calculated data represents the eco-efficiency-ratio between economical and ecological performance data. Depending on the boundary conditions, it could become necessary to include up- and downstream related processes into the regarded model, which would increase the amount of necessary indicators. Using adequate software packages helps to deal with the rising requirements. As a kind of conclusion, a fourth step towards a critical review of the provided results is necessary in order to achieve a continuous improvement towards eco-efficiency.

The following diagram shows the modelling of a chemical process. The width of the single flows is proportional to the mass quantity.

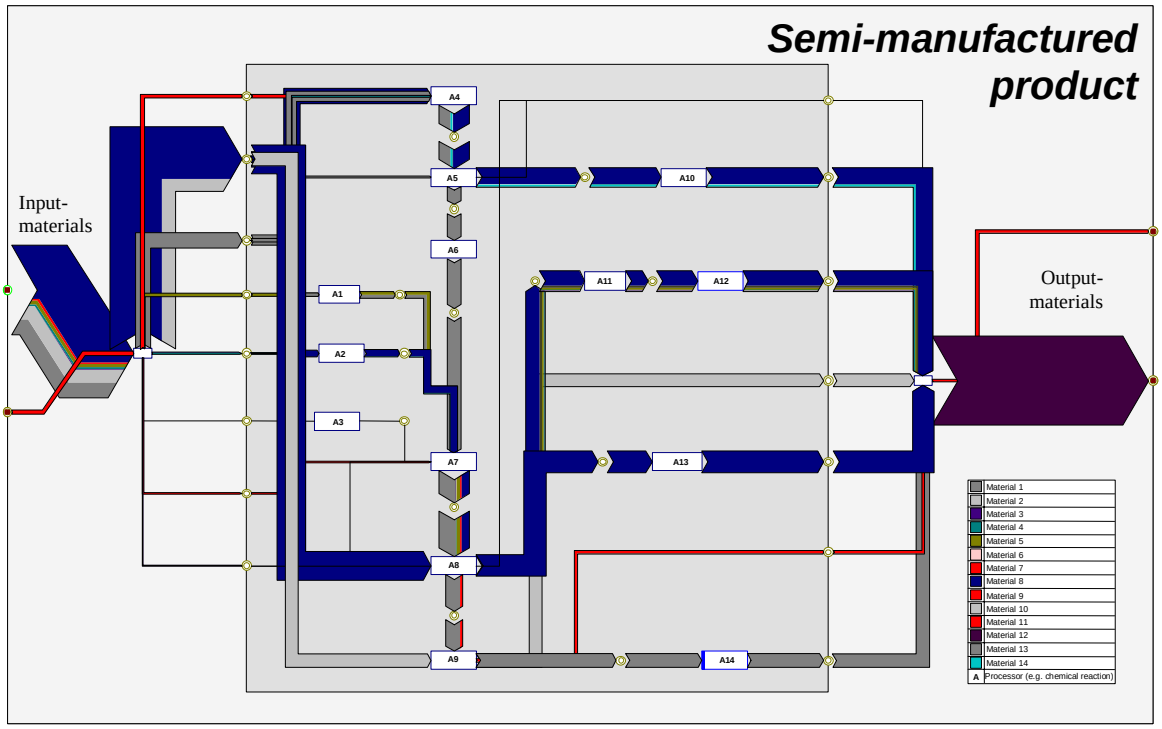

Figure 1: Example of a sankey-diagram combined with a semi-manufactured product

Based on the experiences within the practical implementation it could be proved, that the evaluation procedure concept can successfully be applied in pharmaceutical companies. Depending on the data availability, a transfer to other industry sectors (e.g. automotive sector) is possible.

The planned presentation will include the methodological background of the evaluation concepts as well as its practical application in a large pharmaceutical company.