Beyond Compliance. Environmental Management and Toxics Reduction in Practice
Verschoor, A.H.

Citation for published version (APA):

General rights
It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

Disclaimer/Complaints regulations
If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: http://uba.uva.nl/en/contact, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.
Chapter 5

The use of life cycle methods by seven major companies.

A.H. Verschoor and L. Reijnders, J. Cleaner Production (accepted).

keywords: life cycle methods, environmental impact, toxics, international company, valid data.
Abstract

We studied how 7 large international companies are applying life cycle methodology to their products. The study comprised questions about the involvement of the purchasing department and also about the inclusion of toxics in the life cycle studies.

The participating companies are using 5 different life cycle methods. None of them used the ‘full LCA’. The use of life cycle methods is mostly infrequently. At the companies studied use of LCA methodology was not internalised but rather at the starting stage. In 4 cases reasons for development of the life cycle studies are coming from outside the company. Five of the seven companies mentioned problems gathering valid data. The results of life cycle studies are used for different applications. In five cases results of the life cycle methods are used for activities which may lead to environmental impact reduction. Three companies developed life cycle methods for a database. The use of the results for purchasing purposes occurred at 2 companies. Only in one case the purchasing department was involved in the development of the life cycle method. This restricted involvement limits the potential environmental impact of life cycle studies. None of the companies uses or intends to use the life cycle method for toxics reduction. Two companies used ‘risk assessment’ and one company a ‘black list’ for this purpose. In all the studies the attention to toxics was insufficient to prevent potential shifts of hazard to the work environment.

Introduction

For environmental improvement it is important for a company to understand and reduce the environmental impacts of its products, processes and services (1). An important approach to reduce the environmental impacts is pollution prevention. In a pollution prevention assessment the system boundaries are drawn very narrowly around the facility. Processes however are part of a production-consumption chain and interlinked through suppliers and customers (2). An approach to the consideration of the whole impact of the production - consumption chain is life cycle assessment (LCA). LCA may be used for environmental impact reduction but also to learn about the impacts of products from ‘cradle to grave’. The first attempts to look at extended product systems focused on calculating energy
requirements during the 1970s after the first oil shock. The attention for environmental releases were limited. The renewed interest in LCA dates from the late 1980s and includes non-energy related impacts. The applications and benefits of LCA are described in literature (1,2,3,4) but there is also some criticism. LCAs are very data intensive, which means the success of a study is strongly dependent on the availability of good data. (2)

Krozer and Vis (5) discussed the methodological imperfections of LCA, they stated that the LCA method is still in development, data availability is hardly sufficient. Owens (6) states LCA is not capable or sufficient by itself of generating a comprehensive environmental assessment of any system, more focused assessments using other analytical techniques are often necessary. Baumann (7) and Grotz (8) concluded that industry is internalising life cycle assessment methodology. Their work showed that the prevailing objective of life cycle studies performed by industry is product and process optimisation and information purposes. Baumann and Grotz however did not study which life cycle methods are used by industry.

In this study we will address a number of questions about the internalisation and use of life cycle methods. We studied what kind of life cycle methods companies are using and if companies experience problems in performing life cycle studies especially with regard to data (2) and methodology (5). Furthermore we looked for verification of the findings of Bauman and Grotz, as to the internalising by companies of life cycle assessment methodology. We studied for what purposes life cycle methods are used. We also addressed the question if purchasing departments are involved in the development of the life cycle methods. Because the purchasing department actually buys materials and products, the purchasing department is in a strategic position to reduce the impact of bought products and materials. In order to do so they should be able to influence and control the actual purchasing in line with the environmental policy of the company (9). Involvement in life cycle studies may give the purchasing department expertise to contribute to environmental improvement.

We also studied whether the LCA method used includes the toxics. Toxics used in products and processes are not only environmentally relevant but also important for health at the workplace (10). In dealing with potential reduction of toxic emissions one should be aware of negative effects of the toxics involved on the
work environment. Characterization of toxic chemicals with relevance to human exposure in the work environment does normally not belong to LCA. Integration of this aspect in LCA or the use of other methodology is needed to assess the work place health effects (10,11,12,13).

To answer the questions we selected seven large international companies (table 1) that were known to have performed life cycle studies and, more in general, have a well developed environmental management system. The last criterion was used to ensure that there was sufficient environmental expertise in the company.

**Table 1**

### Participating Companies

1. Novo Nordisk
2. Volvo.
3. The Body Shop
4. Procter & Gamble
5. DSM, N.V.
6. Credit Suisse
7. Hoechst Group

**Life Cycle Methods**

There is a variety of life cycle methods, the following are described in literature. A full LCA (3,14,15,16) systematically analyses and quantifies environmental impacts of a product from resource extraction to final disposal. The full LCA has four components: goal and scope definition, quantitative inventory, impact assessment and interpretation (3). The goal definition and scoping stage defines the intended application, the scope, the functional unit, the system boundaries and data quality. The quantitative inventory quantifies the resource use, material use, energy use and environmental releases during the entire life cycle of the product. The impact assessment is an assessment of the potential impacts with the identified forms of resource use and environmental emissions. The last stage of the LCA is the interpretation of the results of the study in relation to the objectives of the study.

An LCI (Life Cycle Inventory) differs from a full LCA. An LCI covers the first two steps of the full LCA: goal definition and scoping stage and quantitative
inventory. An LCI usually examines the entire production and consumption chain of a product from resource extraction to final disposal of product associated waste. Sometimes an LCI is only carried out for the processing part within the company giving a so called 'cradle to factory gate' LCI.

Shorter ‘screening’ LCA’s (17,18) comprise of, in general all steps of the full LCA, but tend to focus on major impacts and are less quantitatively orientated.

The EPS (Environmental Priority Strategy) (17) is an example of a screening LCA. The principle used for the EPS is to describe impacts on the environment in terms of impacts on one or several safeguard subjects (human health, biodiversity, production, resources and aesthetic values) and value changes in them according to the willingness to pay to restore them to their normal status. Impact on safeguard subjects are valued in ELU (Environmental Load Unit), according to the willingness to pay for avoiding negative effects on safeguard subjects. Emissions, use of resources and other human activities are valued according to their estimated contributions to the changes in the safeguard subjects.

The Ökobilanz (18) is a sort of partial screening LCA. The Ökobilanz consists of two parts the ‘Kernbilanz’ and the ‘Komplementärbilanz’. The ‘Kernbilanz’ comprises the data derived from the impacts of the company’s direct activities. In the company studied impacts are compiled from the electricity used, heating, water, waste and (intern) transport. The ‘Komplementärbilanz’ comprises data from the indirect impacts. In this ‘Bilanz’ the company studied compiled impacts as to the paper used (the impacts during the production of the paper), external transport, business trips (car and public transport), commuter traffic. The data from the ‘Kernbilanz’ and the ‘Komplementärbilanz’ are calculated in UBP (Umweltbelastungspunkte).

Method
The study was carried out by structured interviews, from June 1996 until July 1997 (table 2). One to three persons (selected for the subject) per company were interviewed. In most companies (5 companies) people working at the Corporate Environmental Department were interviewed. In two cases a member of the Division Research and Development was interviewed. In one case beside the member of the environmental department on the headquarters a member at the product design and engineering site was also interviewed. When present, written
material was collected (Corporate Environmental Report, reports on life cycle studies of products/processes or procedures). Most of the interviews were recorded (6 companies). All interviews were transcribed into a written text and then sent back to the interviewed persons for comment on correctness. The interview texts were finalised on the basis of these comments.

The interview was structured into four parts with open questions (table 2). The first part is intended to get insight into the question which life cycle methods are used. The second part focuses on the problems and results and the handling of the results. The third part focuses on the purchasing department. The last part is intended to learn more about toxics and life cycle methods.

Table 2

Interview

LCA
1 Does or did the company use a life cycle analysis for measuring environmental impacts.
2 Why was a life cycle method developed and for what purpose, product, process, other.

Problems and results
3 Are there problems in using life cycle methods or other techniques (like gathering information and data).
4 What are the results of the life cycle technique and how did you use the results.

Purchasing department
5 Did the purchasing department play a role in the development of the LCA’s.
6 Are the results of the LCA’s used when buying products and/or materials. If so how are they used and for what kind of products/processes.

Toxics
7 Does the life cycle technique include the toxics and how.
8 Do the results of the life cycle technique play a role in reducing toxics.
Results
The results from the interviews are given below. A summary is to be found in tables 3 and 4.

Company 1, Novo Nordisk, workforce 13000.
This biotechnical company has companies and production facilities in 54 countries. The information used was collected by interviews at the Corporate Environmental Affairs at the headquarters and written material. The company uses large quantities of raw materials. The company has no environmental requirements for raw materials but has to comply with the quality requirements of the Food and Drugs Administration. An LCI for quantifying the environmental impact of products was done for one product. The company started developing the LCI because of questions from product users. Some products of the company are used in other large value products. The company did not have much experience in the field of LCAs at the moment of the interview (June 1996). There were many problems gathering the information and data from the suppliers. Some acquired data gave problems because of confidential product information. Other data are simply not available because suppliers involved are not developing in this field. Some acquired data were inconsistent. For the LCI actually performed some data were estimated. The questionnaire for suppliers used for gathering information comprises questions about ecotoxicity, biodegradability, bioaccumulation and human toxicity. The results of the LCI inventory are specified in: use of resources, use of energy, air emissions, waste water emissions and solid waste. The results are intended for customers and for evaluating the environmental performance of the application. The purchasing department was involved in developing the LCI procedure. The results of the LCI are however not used for purchasing purposes. The toxic materials are only specified in the solid waste. The toxicology of the product for which the LCI is performed is classified. The company does not use the LCI for toxics reduction.

Company 2, Volvo, workforce 72000.
This company out of the automotive industry has production facilities in 23 countries. The information used was collected from interviews of the environmental manager at the headquarters and the person who was working with the technique
at the product design and engineering site of Netherlands Car B.V.. The company, in collaboration with others, developed the Environmental Priority Strategy (EPS). The company uses the EPS unfrequently. The EPS is developed as one of the criteria, besides durability, technical and financial aspects, to make decisions and choices for products, materials and design. According to the company the status of the knowledge as to how different emissions contribute to effects in the environment is, in many aspects, poor. Estimates therefore have to be accompanied by error figures, which sometimes have to be several orders of magnitude. The company states that, the EPS is not an objective scientific method, there are political and economic aspects to be considered in the method. It is also stated that it is hard to choose between the different life cycle methods, which give priority to different things.

The company itself gathered most of the data necessary for performing the EPS. In Sweden industry, university and government are working together in a competence centre to establish quality assured data for the EPS in a data base. The industries are gathering the data. The competence centre assures the quality. Most of the time the company is using the data from the competence centre data base, seldom are correct data provided by the suppliers. The EPS is used also as a simple tool for the designer (product development) to know in a more or less quantitative way whether he is on the right path. Another aim is to calculate the total environmental load of the cars in ELU (Environmental Load Unit). The amount of ELU reflects the willingness to pay for avoiding negative effects. The ELU is also used as a unit to quantify the various impacts of the cars, materials or components. The purchasing department played a small role in developing the EPS. They were only involved when data are needed from suppliers. The results derived from the EPS are not used yet for buying products and materials.

To exclude some toxics the company uses a 'black list'. Beside the 'black list' the company uses a 'grey list' of toxic substances whose use is to be restricted. The EPS method used does not apply to the materials on the 'black list'. The company states that, for toxics reduction the EPS is useful because the method identifies the toxics and you are able to compare alternatives. There is however no evidence that the EPS method is actually used for toxics reduction.
Company 3, The Body Shop, workforce 4000.

The company has production sites and shops in 45 countries. The information used is derived from written material and an interview at the environmental department at the headquarters. The company uses large quantities of raw materials. The company developed its own life cycle method for gathering quantitative and qualitative information from suppliers of products and raw materials. The method developed differs greatly from the life cycle methods described in the introduction. The method consists of a questionnaire. The questionnaire for products covers manufacture, use and disposal of products. Most questions have to be answered with a yes or no. There are questions about the materials, for example whether they are derived from renewable resources but also questions about non-environmental issues like fair trade, fair prices, working women, and discrimination. Furthermore there are questions about the sterilizing treatment of the products, health and safety risks during the production. Also there are some quantitative questions for example about the COD (Chemical Oxygen Demand) for liquid effluent and the concentration of total synthetic detergents. There are further questions about packaging, use of recycled materials, toxic substances leached from the packaging in the product and whether the packaging is reusable or recyclable. Questions about waste, risk of the waste to the environment and biodegradability of waterborne waste are also included. In order to maintain confidentiality for the supplier, the life cycle method and scoring is carried out by an external consultant.

The 'life cycle' scoring for raw materials has a formula computing overall scores, in such a way that the quantitative sections covering energy and raw materials inputs and wastes account for 50% of the overall score. Failure to provide an answer automatically scores zero. The information is used by the Purchasing Department and the Product Development Department. Whether the raw material should be investigated is determined by the quantity used and ecological saliency. The 'Life Cycle' schemes of fifty percent by weight of the raw materials are providing useful information (57 out of 85 ingredients). The results of the questionnaire are, besides other criteria, also used for rating the supplier. The Life Cycle scheme is not applied for toxics reduction. The company uses 'Risk Assessment' for the toxics as being more appropriate.
Company 4, Procter & Gamble, workforce 100,000.
The company is a consumer goods company operating globally in over 140 countries. The information used is derived from written material and an interview at the division Research & Development in The Netherlands. The Environmental Quality Group co-ordinates a worldwide environmental program. The same standards are met in the company worldwide. The company uses the LCI, Life Cycle Inventory. The impact assessment is not carried out because, it is stated, there is not a generally accepted method (19). The company states that an LCI can be used directly for finding improvements in resource use and waste management (20). According to the company neither LCI or full LCA can be used to assess environmental safety.

The company in co-operation with others worked on a data base for LCIs. Problems still exist in gathering reliable data. For the same process there can be a difference in data depending on the manufacturer. In that case choices have to be made to use one mean value for all manufacturers or more data for different manufacturers in the database. Data from their own suppliers are used as much as possible. The results are used within the company to compare the products. Results were also used to substantiate discussions, for instance discussions about the use of renewable or non-renewable raw materials. The purchasing department did not play a role in the development of the LCIs but the results are used for buying. In that case the results are translated in product specification. The company states the use of an LCI is very important, ‘you have to know what are the environmental effects of products and processes’. The company does not use the LCI for toxics reduction. The company uses ‘Risk Assessment’ for the toxics as being more appropriate.

Company 5, DSM N.V., workforce 17000.
The company out of the chemical industry has its production sites mainly in Europe and the USA. The main production sites and the headquarters are located in the Netherlands. The information used here was collected by written material and an interview at the Corporate Safety, Environment Health & Technology Department at the headquarters. The company uses the LCI to perform an ‘eco-profile’ for some of their polymeric products. The LCI data are derived from the processing part of the company (so called cradle to factory gate). The performed
LCI contains the data specified as waste, energy, water use and emissions into water and air. The data are intended for a data base containing mean European plastic data established under the Association of Plastics manufacturers in Europe (APME). The company states the data in the data base can be used by customers, who can add up their process data to the data provided. In some cases the company also provided data requested by customers, for instance customers out of the automotive industry. The company only generates data and does not use data from suppliers.

The LCI’s can also be used in selling and marketing the companies products. The LCI is not intended for reducing the environmental impacts, but can be used for research and development. In one case an LCI was used to provide data for studying the possibility of starting the recycling of a product. The results showed that recycling was a possibility, but that a waste problem was the result. For this waste problem a technical solution was provided. Product stewardship, audits and questionaires are in use for the reduction of the environmental impacts of the companies activities. The purchasing department did not play a role in the development of the LCI’s. The reason given was that the expertise in this field is at the corporate Safety, Environment & Health Department. The results are not used for buying.

LCI’s are not used for toxics reduction. The company states that reducing the risk of toxics is more important than reducing the hazard by toxics reduction. In line with this, toxics reduction is not felt to be a target though toxics emission reduction is.

**Company 6, Credit Suisse, workforce 26000.**
The company is a leading financial services group. The headquarters and more than 350 offices are located in Switzerland and about 100 offices in several countries. The information used here is derived from written material and an interview at the environmental department at the headquarters.

The company uses the ‘Ökobilanz’ to qualify and quantify the environmental impacts caused by the company’s activities. The ‘Ökobilanz’ was performed for the headoffices in 1994 and did include about 60 % of the company’s buildings area in Switzerland.

The ‘Ökobilanz’ consists of two parts, the ‘Kernbilanz’ and the ‘Komplemen-
Not all the impacts are compiled. The company had problems gathering the necessary data for the ‘Ökobilanz’. For instance some data did not exist, some data were derived from at random samples or were estimated by calculation. The ‘Buwal’ data base (21) was also used.

Of the UBP (Umweltbelastungspunkte, Environmental Load Units) in the ‘Kernbilanz’ 79 % is due to the electricity used. The results are used to compare the environmental impacts between the several offices and with the results of other banks using the UBP. The results are also used for communication with the several stakeholders (co - workers, suppliers, business partners). The purchasing department did not play a role in the development of the ‘Ökobilanz’ and the results are not used for buying. The ‘Ökobilanz’ does not contain data regarding the toxics. The company uses other procedures to reduce the use of toxic products, because that is deemed more appropriate.

**Company 7, Hoechst Group, workforce 150.000.**

The company is an international network of companies out of the pharmaceutical, agricultural and chemical sectors operating in over 120 countries. The information used here was collected by written material and an interview at the R & D and Production at the headquarters. The company together with 13 other partners (major surfactants manufacturers, intermediate suppliers and surfactant users) participated in a project ‘ The European Life- Cycle Inventory for Detergent Surfactants Production’ (22). The study is an so-called partial LCI (cradle to factory gate study). The study also refers to the lack of an agreed Impact Assessment (19), for this reason an Impact Assessment is not carried out.

The study (22) focused on surfactants produced for the European market. The data for the study were obtained from a broad range of sources, including more than 10 unpublished company specific data bases, data from research organisations as well as published data. The study followed as much as possible ‘The principles of the Society of Environmental Toxicology and Chemistry (SETAC) (23). After the mentioned study the company performed a second surfactant study with the same partners and the same technique. The main purpose of the LCI study was to facilitate objectively surfactant assessment on environmental grounds. However the results were said to show, given the complexity of the analysis, that compiled LCI data should be used mainly to identify opportunities for improve-
ment within each individual surfactant system rather than to attempt direct comparisons between them. There were problems, mainly in the beginning, in gathering valid and correct data. The purchasing department did not play a role in the development of the LCIs and the results are not used for buying. Internally the company uses a similar but less extensive technique, the ‘Material Flow Analyses’. The Material Flow Analysis is used for decision making in product development. This technique is used frequently. The company reduces environmental impacts mainly on the basis of the ‘Material Flow Analysis’, audits and a technique called ‘Product Risk Evaluation Process’. In the LCI the toxics are not specified. It is stated a toxicity profile is made for all products. The profile includes a. o. the aquatic toxicity, biodegradability and human toxicity.
### Summary of the results, about the use of life cycle methods in 7 major companies

<table>
<thead>
<tr>
<th>Company</th>
<th>(Life Cycle) technique used</th>
<th>technique frequently used</th>
<th>problems gathering valid data</th>
<th>results used for purchasing dep. involved in development life cycle method</th>
<th>result s used for buying</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Novo Nordisk</strong></td>
<td>LCI</td>
<td>-</td>
<td>yes</td>
<td>*customers *evaluation environmental performance of the application</td>
<td>not</td>
</tr>
<tr>
<td><strong>Volvo</strong></td>
<td>EPS</td>
<td>-</td>
<td>yes</td>
<td>product development</td>
<td>not</td>
</tr>
<tr>
<td><strong>The Body Shop</strong></td>
<td>own questionnaire</td>
<td>+</td>
<td>?</td>
<td>*purchasing and product development department *rating suppliers</td>
<td>?</td>
</tr>
<tr>
<td><strong>Procter &amp; Gamble</strong></td>
<td>LCI</td>
<td>+/-</td>
<td>yes</td>
<td>*comparing the products *purchasing and product specification *substantiate discussions *data base</td>
<td>not</td>
</tr>
<tr>
<td><strong>DSM N.V.</strong></td>
<td>LCI ‘cradle to factory gate’</td>
<td>+/-</td>
<td>produces data</td>
<td>*data base *providing data for customers</td>
<td>not</td>
</tr>
<tr>
<td><strong>Credit Suisse</strong></td>
<td>Ökobilanz</td>
<td>-</td>
<td>yes</td>
<td>*compare the environmental impacts *communication</td>
<td>not</td>
</tr>
<tr>
<td><strong>Hoechst Group</strong></td>
<td>LCI ‘cradle to factory gate’</td>
<td>-</td>
<td>yes mainly in the beginning</td>
<td>*data base *identify opportunities for improvement</td>
<td>not</td>
</tr>
</tbody>
</table>

+= frequently

+/-= unfrequently but more than once or twice

-= once or twice

106
Discussion and conclusions

The results of this study show (table 3,4) that companies are using a variety of life cycle methods. Interestingly, none of the companies mentioned responded to regulation as a reason for life cycle studies. This is at variance with the findings of Berkhout (24) who states that regulation is the main driver of environmental initiatives in industry, and has also played an important role in encouraging firms to adopt life cycle approaches. In 4 cases, reasons mentioned in this study for development of the life cycle studies were coming from outside the company (company 1 started caused by questions of customers and 3 companies developed for a data base with other participants). Most (six) companies applied the life cycle methods in a very limited segment of their products. The use of life cycle methods is mostly unfrequent. Most of the participating companies state they use other techniques than life cycle methodology for the reduction of the environmental impacts of the company. The full LCA (3,14,15,16) was used by none of the companies. Disagreement about impact assessment (19) was mentioned twice as a reason for not using the full LCA. One of the companies developed its own method. The life cycle methods used differ a lot also in complexity.

This study does not show that companies are internalising life cycle methodology, it may show that most of the companies studied are starting. The sample studied is too small to draw conclusions for industry in general. However this finding is in line with the findings of Berkhout (24) about the adoption of life cycle approaches by European industry.

Five companies reported having problems gathering valid data due to suppliers not having the required data, the data are confidential or the provided data are not valid and / or correct. As LCAs are very data intensive this can lead to uncertainty in the results of performed life cycle methods. This is in agreement with the findings of Neitzel (25) and Krozer and Vis (5). The results from the life cycle methods are used for a variety of applications both internal and external (table 3). Bauman (7) and Grotz (8) also showed varying applications but the prevailing objective of the LCAs was product and process optimisation and information purposes. Three companies in our sample are using the results for a data base. The data compiled in data bases are often presented in the form of industry averages in order to preserve the confidentiality of such inputs (22). The use of such data
however does not reflect between company differences. Two companies mentioned these problems. One company states that these compiled data should be used mainly to identify opportunities within each individual product system and not for between product comparison. In five cases life cycle methods are used for activities which can lead to environmental impact reduction by process and product optimalisation. This is in agreement with the findings of Bauman (7) and Grotz (8). Two companies used the results for purchasing and in one case the purchasing department was involved in the development. This restricted involvement of the purchasing department limits the potential environmental impact of life cycle studies because this department actually buys materials and products, the purchasing department is in strategic position to reduce the impact of bought products and materials (9). None of the companies used life cycle methods for toxics reduction, or intends to use them for this purpose (table 4). Two companies did not include toxics at all in their life cycle studies. In the other studies the attention to toxics was insufficient to prevent potential impact shifts to the work environment. Two companies used ‘Risk Assessment’ for the dealing with the toxics and one company a black list. Apparently the existing life cycle methods are not felt to be the right methods for toxics reduction.
<table>
<thead>
<tr>
<th>Company</th>
<th>Toxics reduction a target?</th>
<th>Toxics integrated in the life cycle method used</th>
<th>Toxics reduction induced by the life cycle method used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novo</td>
<td>+</td>
<td>+/-</td>
<td>-</td>
</tr>
<tr>
<td>Volvo</td>
<td>+</td>
<td>+/-</td>
<td>-</td>
</tr>
<tr>
<td>The Body</td>
<td>+</td>
<td>+/-</td>
<td>-</td>
</tr>
<tr>
<td>Procter &amp; Gamble</td>
<td>+</td>
<td>+/-</td>
<td>-</td>
</tr>
<tr>
<td>DSM N.V.</td>
<td>-</td>
<td>+/-</td>
<td>-</td>
</tr>
<tr>
<td>Credit</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Hoechst</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

+    = no  
+/-  = little  
-    = yes
References


