Sustainability of products

What it's all about

cefic

Contents

Foreword

In May 2012 the European chemical industry published its first sustainability report, outlining the sector's vision to play a key role in ensuring that by 2050 over nine billion people live well, within the resources of the planet. Making this vision a reality means, among other things, that our industry strives to be sustainable in terms of its operations and to be a key enabler of a sustainable society through the excellence of its employees and the benefits of its products.

It is important that sound science be used as a critical element to ensuring industry, society and governments make good choices in terms of product selection, technology options and framework conditions. Today, resource efficiency is becoming as important an element of the sustainability of products as chemicals safety.

This document is an introduction to how sustainability may apply to chemicals in practice. It explains approaches that industry can use to make science-based choices in product development and assessment. It is particularly aimed at smaller companies, as part of Cefic's programme to help deliver the chemical industry's vision.

Hubert Mandery
Director General, Cefic

Introduction

1

1.1 WHAT DOES THE FUTURE HOLD FOR CHEMICAL SUPPLY CHAINS?

The chemical industry is well placed to tackle the challenges of sustainability, given the industry's proven track record in innovation, its deep integration in the supply and value chains, and its global presence. Through innovation linked to continuous improvement, chemical companies can help resolve some of the world's biggest challenges.

The industry has already made significant achievements in sustainability, driving safe, environmentally sound operations through its Responsible Care® scheme and Corporate Social Responsibility activities. These efforts were started well before the United Nations' Rio Declaration in 1992 and have become ever more important since.

Today, emerging regulatory and social trends around sustainability create both pressures and opportunities for chemical companies at global and EU levels. Legislative requirements, stakeholder expectations and companies' own business and Responsible Care strategies are driving the development of more sustainable chemical products and supply chains.

Clear trends are already surfacing:

- The introduction of REACH creates new pressures on specific substances.
- The emergence of eco-design, Green Public Procurement (GPP), Ecolabel criteria and waste prevention schemes is creating demand for more sustainable products.
- Rising consumer interest in sustainable goods is incentivising retailers to develop sustainability measures for their suppliers.

The move towards sustainable products will take many years to progress through legislative and business processes. During this time, retailers, consumers and non-governmental organisations (NGOs) will continue to call for transparency and clear statements about the constituents of the goods they purchase.

1.2 PLANNING AHEAD – WHAT CAN YOUR COMPANY DO?

Ensuring safety for human health and the environment – using science-based tools such as risk assessment – is a prerequisite for chemical companies. These tips will help you move further on product sustainability.

- Make sure that gaining some basic **expertise in the field of life cycle assessment** is included in your medium and long-term planning. This will help your company make the most of potential opportunities.

- Remember to **consider all aspects of the product footprint** in your sustainability assessments: the environmental, social and economic viewpoint.

- Keep yourself informed of the **key regulatory and political developments**. Cefic and national federations are there to help companies gauge what is happening in Europe and beyond.

- Start by **exploring this document**. It contains science-based tools companies can use when evaluating their products. It also outlines points to be borne in mind when discussing product sustainability issues with stakeholders to help initiate this process within your company.

The information provided in this document is not exhaustive. It discusses pros and cons of potential options and provides a “to do” list of first actions to be taken, covering the three pillars underpinning sustainability – environmental aspects together with social and economic criteria.

The case for life cycle thinking

2

If the chemical industry is to help nine billion people live well, within the limits of the planet, we need to find ways to provide the likes of housing, health and hygiene in the most resource efficient way, with minimum burdens placed on the environment.

This applies not just to products themselves, but to the whole product life cycle – from cradle-to-grave or even cradle-to-cradle. It includes the impacts of raw material sourcing, manufacture, packaging, transport and distribution, retail, use and then post-use recovery or disposal.

Any sustainability assessment of products or services needs to be both integrated and based on a life cycle approach.

2.1 WHAT IS AN INTEGRATED LIFE CYCLE APPROACH?

- **Integrated**: The assessment looks at all three pillars of sustainability – environmental, social and economic. Considering these aspects together helps identify how to deliver benefits in all areas, or at least to inform decisions if trade-offs between the different pillars are required. The same applies to decisions within each pillar. For example, improvement in one environmental area – such as air, water, land or biodiversity – may have trade-offs in another area.

- **Life cycle**: The assessment considers the whole life cycle that delivers the product or service to ensure that it is delivered in the most cost- effective, environmentally efficient and socially acceptable way. While life cycle approaches often focus on the environmental pillar, looking at the social and economic aspects is equally important.

The main benefit of this approach is that it helps prevent problem-shifting. It ensures that all aspects of a product or service's life cycle are considered to generate an optimum solution. A further benefit is that, by linking all impacts to the service provided by the product, it helps optimise service delivery and improve resource efficiency.

It is important to integrate all pillars of sustainability in any decision-making process. Assessment tools often combine aspects of environmental, social and economic analysis, but for the sake of clarity and simplicity, this guide will deal with these areas separately.


PACKAGING
DISTRIBUTION
USAGE
DISPOSAL
MATERIALS
MANUFACTURING

2.2 WHAT IS A CLOSED LOOP APPROACH?

Companies are increasingly moving from linear production models to closed-loop value chains. This means that a by-product from one process becomes the raw material for another process.

Closing the loop can help improve resource efficiency and security of supply and reduce costs for waste management and disposal. The move towards closed-loop models is thus accelerated by rising commodity prices and increasing scarcity of resources. Moving from a linear to a circular economic model is also promoted by policymakers in some regions. “Circular economy” legislation has been enacted in countries such as Germany and China.

There are different ways of closing the loop:

- The simplest closed loop is **re-use**, where a product is re-used without need for remanufacturing.
- When recovery and material recycling is needed, then closed loop recycling involves taking the product or material back for **use in the same application**. An example would be the recovery of PET water bottles for the production of further bottles.
- A wider loop occurs where used materials are recovered for subsequent **use in a different application**, such as the recovery of PET from bottles for use as fibres for clothing or insulation. Such processes are sometimes termed up-cycling or down-cycling according to whether the second use has a higher or lower perceived value.

The priority for material use is that the loop is closed, rather than material being lost from the system and disposed to landfill. The choice between the different options will depend on an overall sustainability evaluation, which will include environmental effectiveness, economic efficiency and social acceptance.

While closing the loop makes both economic and environmental sense in many cases, it is important to take a broad view of the energy use, emissions and overall environmental impact generated by chemical products and processes. Tools such as Life Cycle Assessment (LCA) can help identify the most sustainable strategy.

IN PRACTICE

CLOSING THE LOOP AT P&G

96% of all materials that enter P&G manufacturing plants leave as packed products. By identifying all of the remaining materials, and alternative uses for them, the company has reduced solid waste going to disposal by 57% in four years.

Examples of secondary uses for such “waste materials” include:

- Using paper-making sludges and residual fibres to make roofing tiles for low cost housing;
- Turning used vegetable oil from Pringles production into biodiesel;
- Using dilute wash water from detergent production in car washes.

IN PRACTICE

SME TURNS ENVIRONMENTAL NEED INTO INNOVATION OPPORTUNITY

Finnish SME AkkuSer recycles batteries and accumulators into valuable metals suitable as raw material for reuse. The company's patented technology extracts metals such as nickel, cobalt and iron as well as compound materials which are then further processed by its customers.

The method raises the recovery rate of these metals above 90% and reduces energy consumption compared with conventional recycling techniques. This work is important because the rapidly growing demand for mobile electronic devices and the resulting battery waste is an environmental concern, due to the heavy metals and hazardous chemicals contained.

Founded in 2005 and currently employing 10 people, the company won the European chemical industry's Responsible Care SME award in 2011. AkkuSer was praised for its technological approach as well as for turning an environmental need into a business case.

Managing products

3

Sustainable products provide environmental, social and economic benefits while respecting public health, welfare, and environment over their full life cycle, from the extraction of raw materials to final disposal. Sound product and process management practices are crucial to make this happen.

3.1 PRODUCT SAFETY MANAGEMENT

A key aspect of sustainability is ensuring that products – existing and new – are safe for their intended uses. Product stewardship involves the active management of chemical products on site and beyond, and a dynamic engagement with downstream users and suppliers.

Product characteristics and functionalities should be considered based on a life cycle approach, including:

- **Risk-based analysis** (including hazard and exposure) of safety, health and environmental impacts of existing and new industrial processes, activities and products throughout the life cycle;
- **Reduction of actual and potential risks** by several means, including product labelling, product handling precautions, product use restrictions, and substitution if needed;
- **Commitment to continuous improvement** in product design, assessment practices, education, communication and customer support;
- Clear commitment to provide **product information and support** along the whole value chain as appropriate to ensure safe handling and use;
- **Partnerships** with authorities, local community and NGOs to prevent accidents and answer public concerns.

3.1.1 Developing new products

There are many more reasons for a company to consider new product development rather than just improving margins. It could be, for example:

- to improve its own **production efficiency** with a view to reducing waste generation or limiting resource consumption;
- to **increase safety** for workers, customers and the environment by reducing exposure or choosing less hazardous substances;
- or simply because one of its suppliers has brought a new product onto the market, which offers **novel and improved properties**.

These changes can be motivated by factors including the company's own Responsible Care product stewardship programme, customer demands or a change in legislation. Planning ahead makes good business sense. Keeping informed of emerging legislative and social trends helps identify the substances and product ranges that are the most likely to be successful in the long term, and working with upstream and downstream supply chains can deliver true benefits in terms of meeting and pre-empting new product expectations.

When developing a new product or product range, companies will make choices based on the customers they wish to supply. For example, the issues to be considered will be different if the product is to end up in a consumer application rather than an industrial application – although some issues, such as safety, are common to both.

IN PRACTICE

PRODUCT INNOVATION IN THE BUILDING SECTOR

The building sector is one of the key sectors that can contribute to a more sustainable economy and trigger opportunities for innovative products.

The demand for resource-efficient building materials creates opportunities for materials producers. At the same time, there is increasing focus on human exposure to chemicals through the environment, consumer products and indoor air. This can be expected to initiate further pressures on what chemicals are used in buildings.

One of the strengths of the building sector is its potential to establish closed loop supply chains where waste can be reused and recycled. A good example of a scheme that works and delivers long-term sustainability for all is the recycling scheme established for PVC window frames.

These types of new trends should be borne in mind when assessing product sustainability profiles. They will impact on both the short-term and long-term saleability of products.

SPOTLIGHT: GUIDES ON PRODUCT DEVELOPMENT AND SUBSTITUTION

- International Council of Chemical Associations: "Global Product Strategy – Sound Chemicals Management as Global Responsibility. Living the Principles of Product Stewardship"
- UK Chemical Stakeholders Forum: "A guide to substitution"
- German Federal Environment Agency (UBA): "Guide on sustainable chemicals – A decision tool for substance manufacturers, formulators and end users of chemicals"

3.1.2 Evaluating alternative products

When evaluating alternative products, some key elements should be considered:

- Does the substitute substance offer the same functionality as the substance it is intended to replace, application by application?
- Is the substitute compatible with the process in which it is intended to be used?
- Is the substitute readily available? (For example, is it a rare earth?) Can its supply be easily secured?
- Is there medium or long-term experience of the use and effects of the substitute material?
- Is the substitute's human and environmental profile available? For example, in the context of REACH, it would prove counter-productive to attempt to replace one Substance of Very High Concern (SVHC) with another known SVHC substance.
- What is the impact of the production of the substitute on resource use?
- Are there any potential socio-economic implications?

3.2 PROCESS MANAGEMENT

Companies seek to optimise their processes to reduce energy and other resource use and waste generation. In some instances, this can be achieved by completely rethinking the way the substance is manufactured by using different technologies.

For example, a membrane system could be used instead of a solvent to separate two substances. Chemistry based on renewable materials might present a number of opportunities in this area. For example, a fermentation process can be used instead of a traditional petrochemical one to manufacture some alcohols such as butanol.

Similar to product safety, it is important that a life cycle approach be used when assessing process safety impacts of manufacturing changes. Improvements in one part of the chain can result in trade-offs in other parts of the chain. Process safety risk assessments should be conducted across the supply chain to understand the full impact.

3.3 PRODUCT AND CHEMICAL SERVICES

Sustainable management of chemicals also includes substance-by-service replacement, also known as chemical leasing.

Chemical leasing is defined by the United Nations Industrial Development Organization (UNIDO) as a service-oriented business model that shifts the focus from increasing sales volume of chemicals, towards a value-added approach. The producer mainly sells the functions performed by the chemical, and functional units are the main basis for payment. Functional units can be, for example, the number of pieces cleaned or the amount of area coated.

This system is used in some applications, but it is not applicable to all chemicals and their uses due to feasibility or performance issues. Chemical leasing is an option among other substitution possibilities, but its economic, environmental and social benefits should be demonstrated in each case.

IN PRACTICE

SERVICE SYSTEMS

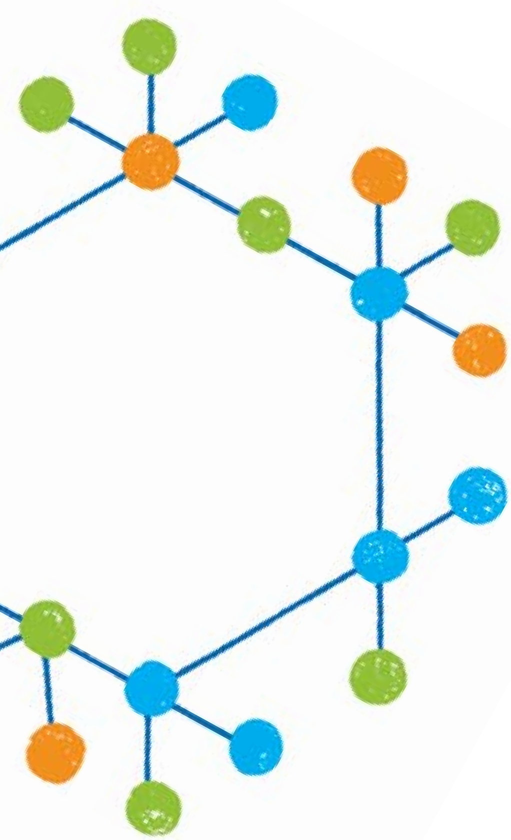
Service systems involve buying the service of a chemical or product, while the ownership of the material stays with the producer.

Examples include:

- **Carpet tiles**: Instead of selling carpets, some companies lease carpet tiles. The customer pays for the area of floor covered for a given time. In this model, the manufacturer has an incentive to create carpet tiles that are more durable, and to use a material that can be effectively recovered and recycled at the end of life. The customer benefits from the function of the carpet, without the need for purchasing, maintenance or disposal.
- **Solvents**: Instead of selling solvents, some companies provide a solvent service, which provides clean solvent and then recovers the used solvent for reconditioning and reuse. Again, the service provider has the incentive to provide only the amount of solvent needed to perform the function, and to be able to recover and recycle the material. The customer benefits from paying for the function, but not needing to source the material or organise recovery or disposal.

Evaluating product sustainability

4 A range of assessment tools exist to evaluate the sustainability of products and processes, focusing on different aspects (environmental, economic and social) and using different methods.



4.1 LIFE CYCLE ASSESSMENT (LCA)

Life cycle assessment methodologies were developed in the 1970s after the energy crisis. While life cycle thinking simply involves taking a life cycle approach, Life Cycle Assessment (LCA) is a structured tool for assessing environmental burdens across the whole product life cycle, either to identify improvement areas or to make comparisons with other product or service systems.

LCA is defined by a series of ISO standards (ISO 14040 and 14044, etc.). Assessment options range in complexity from a “Screening LCA”, which can be used to identify hotspots and areas for improvement, to a full ISO-compliant LCA, which is required when comparisons are communicated externally, for example to substantiate marketing claims by companies or policy choices by governments.

The full LCA process consists of the following stages:

- **Goal and scope definition**: Defining the functional unit for the product or service, i.e. the service delivered to society and the boundaries of the system that are included.

- **Life Cycle Inventory (LCI)**: Identifying all of the material and energy inputs and outputs associated with delivering the functional unit.

- **Life Cycle Impact Assessment (LCIA)**: Evaluating the significance of environmental impacts using the LCI results. In general, this process involves associating inventory data with specific environmental impact categories and category indicators, thereby attempting to understand these impacts. It can include for example global warming potential, ozone depletion potential, eutrophication, and potential resource depletion.

  The LCIA process consists of three mandatory stages:
  - Selection of impact categories, category indicators and characterisation models;
  - Classification: assignment of LCI results to the selected impact categories;
  - Characterisation: calculation of category indicator results.

Optional elements of the LCIA are:
- Normalisation: calculating the magnitude of category indicator results relative to reference information;
- Grouping: sorting and possibly ranking the impact categories;
- Weighting: converting and possibly aggregating indicator results across impact categories using numerical factors based on value choices;
- Data quality analysis: better understanding the reliability of the collection of indicator results, the LCIA profile.

- **Interpretation**: In this phase, the findings from the inventory analysis and the impact assessment are considered together. The results should be consistent with the defined goal and scope. They should reach conclusions, explain limitations and provide recommendations.

- **Peer review**: Any LCA result that is communicated to an external audience should be subjected to a peer review, in accordance with the ISO standard.

SPOTLIGHT: BEWARE! LCA HAS LIMITATIONS

Although LCA is one of the most comprehensive forms of environmental assessment, there are some functions that it cannot deliver. For example, it cannot assess safety and **does not replace risk assessment**.

Human health and environmental risk and safety assessment consider both the hazard of a material, i.e. its intrinsic properties and toxicity, and the exposure of humans or target animal species to the material. The aim is to ensure that the predicted environmental concentration of a material falls below the threshold at which any unwanted environmental effects occur, and thus to ensure safety.

It is therefore necessary to predict the concentrations of each material at specific places and times in the life cycle of the product. LCA is not able to deliver data for the evaluation of intrinsic toxic effects or to assess safety, but LCA is able to use those data for further assessment of toxic or eco-toxic effects over the whole life cycle. LCA can aggregate the data to a final overall assessment.

This means that although LCA is a valuable tool to prevent burden-shifting and to determine environmental impacts over the whole life cycle, it needs to be used together with other tools such as risk assessment for a full evaluation.

IN PRACTICE

ECO2CHEM PROJECT FOR ECO-EFFICIENCY MEASUREMENT

The Eco2chem project, set up at sector level in Belgium and actively supported by local authorities and several research organisations, aims to select the best-fit eco-efficiency measurement methods applicable to chemical processes and products.

The main outcome is SUSCHEMCompass, a web-based tool to help companies, especially SMEs, select the eco-efficiency measurement method best suited to their specific needs. The tool focuses on measurement methods for the economic and environmental aspects at company level and/or project level, but may be extended to social aspects in a follow-up project.

A variety of methods have been identified, ranging from quick scans to thorough life cycle analysis and from freely available tools to proprietary tools. For each method, the web-based tool includes an information sheet summarising the history and scope of the method, and what it can and cannot measure. The tool can be used by all interested parties free of charge.

4.1.1 Choosing the right parameters

In LCA, the functional unit is the unit of comparison between different products or services. As its name suggests, it is related to the function, or service delivered, by the product. The choice of the most appropriate functional unit is essential in any LCA, since it is the unit against which all of the life cycle impacts are normalised.

For instance, in some cases it is appropriate to compare "per tonne of product produced", but for consumer goods it is often more appropriate to consider "per consumer use". Laundry detergents, for example, can be assessed per wash-load.

It is also important that the geographical scope and the defined system boundaries of the data reflect the purpose of the study. For example, to inform decisions at an EU level, the study should reflect the product life cycle across the EU, using data with geographical relevance. Real situation data should be provided even if the production falls outside of the geographical scope of the EU.

4.1.2 LCA tools and databases

A variety of LCA software tools are commercially available to help conduct assessments. Examples include tools such as SimaPro, TEAM, Umberto, Gabi, and others.

In some cases it is necessary to collect life cycle inventory data from the system under study, but there are also a range of sector- and industry-wide databases that can be used to run LCA studies. Examples include databases by Plastics Europe, EcoInvent, the European Reference Life Cycle Database (ELCD), and others.

The type of question that is being asked will determine the type of data required, for example whether it should be industry average, best available technology or actual measured data. Using industry standard data will facilitate conducting LCA studies, but the results have to be interpreted with care. In particular, it is important to ensure that comparisons use data of comparable age, geography, quality standard and scope.

IN PRACTICE

“BILAN PRODUIT” ENVIRONMENTAL ASSESSMENT TOOL

The “Bilan Produit” developed by ADEME, the French Environment and Energy Management Agency, is an environmental assessment tool based on a simplified LCA approach. Aimed at non-specialists and particularly small companies, the tool is available for free from ADEME’s website (in French). ADEME has also conducted a study to adapt a simplified LCA methodology to bioproducts produced from agricultural resources. The study compares existing LCA methods for bioproducts and identifies improvements needed to integrate bioproducts into the “Bilan Produit” tool. The *Study for a simplified LCA methodology adapted to bioproducts* is available in French and English.

IN PRACTICE

WELL TO WHEELS

A type of LCA that is specific to fuel production and consumption has been published by a three-way collaboration of the Joint Research Centre (JRC) of the European Commission, EUCAR, the European Council for Automotive R&D, and CONCAWE, the oil companies’ European association for environment, health, and safety in refining and distribution.

The “Well to Wheels” methodology focuses on fuel production (“Well-to-Tank”) and fuel consumption in modern vehicles (“Tank-to-Wheels”). It estimates energy efficiency, greenhouse gas emissions, and industrial costs for a variety of automotive fuels, including biofuels and powertrain options.

The approach differs from a LCA in that it does not consider energy and emissions associated with building facilities and vehicles or disposing of them at their end-of-life. The third version of the “Well to Wheels” study is available from the JRC website and a fourth version is expected in late 2012.

4.2 CARBON FOOTPRINTING

Recent developments have focused on just one of the environmental impacts over the product or service life cycle – that of greenhouse gas emissions, or the “carbon footprint”. This reflects the recent focus on climate change and the need to manage and reduce carbon emissions.

Standard methodologies for calculating a carbon footprint have been developed by several organisations. Examples include the British Standard BSI PAS 2050, ISO 14067 (in preparation) and WRI/WBCSD Greenhouse Gas Protocols.

Carbon footprinting can help identify where significant greenhouse gas emissions arise in a product or service life cycle and help target improvements. But to ensure an overall environmental improvement, other environmental aspects – such as water – also need to be considered, as do social and economic aspects for an overall sustainability assessment.

4.3 EU ENVIRONMENTAL FOOTPRINT METHODOLOGY

The EU Product Environmental Footprint is a multi-criteria measure of the environmental performance of a product or service throughout its life cycle.

The methodology is being developed by the Joint Research Centre (JRC) on behalf of the European Commission. It is intended to become an integral part of the existing regulatory framework through its introduction as a mandatory requirement into specific pieces of legislation, such as the Ecolabel.

The Product Environmental Footprint criteria take into consideration the recommendations of similar internationally recognised product environmental accounting methods and guidance documents. Specifically, the methodology guides considered were:

- ISO 14044: Environmental management - Life cycle assessment - Requirements and guidelines
- ISO 14067: Carbon footprint of products
- ILCD: International Reference Life Cycle Data System
- Ecological Footprint
- Product and supply chain standards, Greenhouse Gas Protocol (WRI/ WBCSD)
- Méthodologie d'affichage environnemental (BPX 30-323)
- Specification for the assessment of the life cycle greenhouse gas emissions of goods and services
- British Standard for Carbon Footprinting BSI PAS 2050

For each decision point, the guidance aims – wherever feasible – to identify a single requirement in order to support more consistent, robust and reproducible evaluation. This, in turn, would facilitate comparability.

The guidance under preparation is intended as a detailed, stand-alone guide for implementing the requirements for Product Environmental Footprint studies across sectors. However, additional Product Category Rules (PCRs) will be developed by the JRC as a complement to this general guide in order to further increase methodological harmonisation, specificity, relevance and reproducibility.

A Product Environmental Footprint study is based on a life cycle approach, as opposed to focusing on a single phase in the life cycle (e.g. only manufacturing) or a single environmental impact. This helps reduce the possibility of unintended burden-shifting. The methodology aims to consider all relevant environmental footprint impact categories for which sufficiently robust impact assessment methods exist.

It is worth noting that, in parallel, the European Commission is developing a methodology for corporate environmental footprinting.

SPOTLIGHT: ENVIRONMENTAL IMPACT CATEGORIES

The default environmental impact categories covered by the EU Product Environmental Footprint include:

- Climate change
- Ozone depletion
- Human toxicity (cancer effects)
- Human toxicity (non-cancer effects)
- Particulate matter/respiratory inorganics
- Ionising radiation, (human health)
- Photochemical Ozone formation
- Acidification
- Eutrophication (terrestrial)
- Eutrophication (aquatic)
- Ecotoxicity (aquatic, freshwater)
- Land use
- Resource depletion (water)
- Resource depletion (mineral, fossil and renewable)

4.4 ENVIRONMENTAL PRODUCT DECLARATION

An Environmental Product Declaration (EPD) is a standardised (ISO 14025/TR) and LCA based tool to communicate the environmental performance of a product or system.

Environmental Product Declarations can be of three types:

- **Type I: a label or mark authorized by a third party (ISO 14024)**. A Type I label is awarded to a product by a third party based on that product meeting certain criteria pre-established for a given product category. An example of a Type I label would be the EU Ecolabel or the German Blue Angel.

- **Type II: a self-declared claim involving limited environmental elements (ISO 14021)**. A Type II claim is made by the manufacturer based on a product's performance against one or more limited environmental attributes. Specific ISO guidance exists for the following Type II claims: compostable, degradable, designed for disassembly, extended life product, recovered energy, recyclable, recycled content, pre-consumer material, post-consumer material, recycled material, recovered (reclaimed) material, reduced energy consumption, reduced water consumption, reduced resource use, reusable, refillable, waste reduction.

- **Type III: an environmental declaration based on the entire product life cycle (ISO 14025)**. A Type III claim is made by the manufacturer and presents quantified information about the net environmental impacts of a product across its entire life cycle.

4.5 IDENTIFICATION OF HOTSPOTS

A valuable aspect of life cycle thinking is identifying where environmental hotspots occur in product life cycles, so that strategies can be devised to address them. While a full LCA can require considerable time and resources, industry now has LCAs for many existing product categories, and these can be used to guide future efforts.

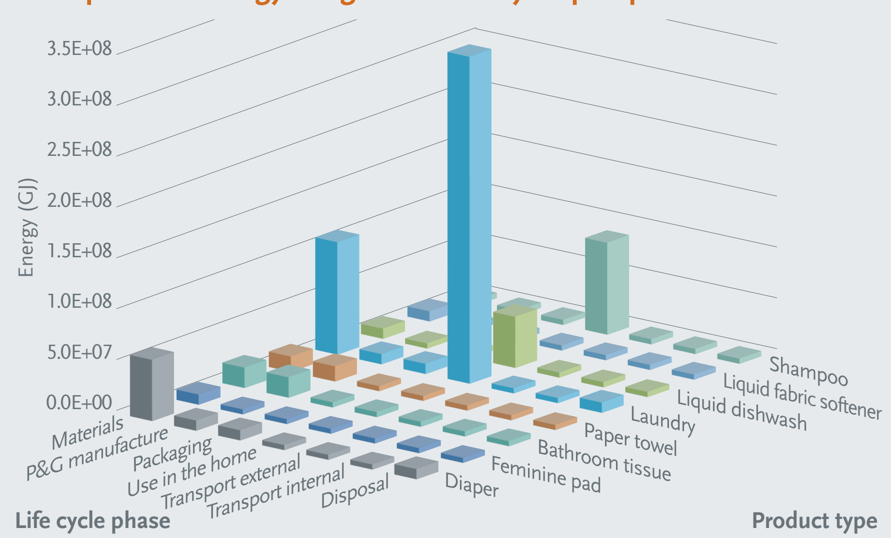
IN PRACTICE

IDENTIFYING HOTSPOTS

In 2002, P&G collated the LCAs for all of its major product categories into an overall energy profile for the company. The analysis showed that the major energy use across the life cycles of all product categories, and hence the major source of greenhouse emissions, was associated with consumers using hot water to wash clothes.

By identifying this "hotspot" it was possible to target R&D innovation efforts to create laundry detergents that work in cold water, and to run consumer campaigns to promote cold water washing. Today, all major detergent manufacturers are promoting cold water washing, both individually and through industry associations such as A.I.S.E. (see the A.I.S.E Charter for Sustainable Cleaning and the Washright/Cleanright consumer portal).

P&G product energy usage from life cycle perspective



Source: White, P.R. (2009). Building a sustainability strategy into the business. *Corporate Governance* 9 (4): 386-394

4.6 ECONOMIC ANALYSIS

Companies use a range of tools to assess and manage the economic aspects of production. Analogously to LCA, Life Cycle Costing (LCC) generates cost figures related to a product using the same system boundaries as in LCA, but focuses on its monetary impacts.

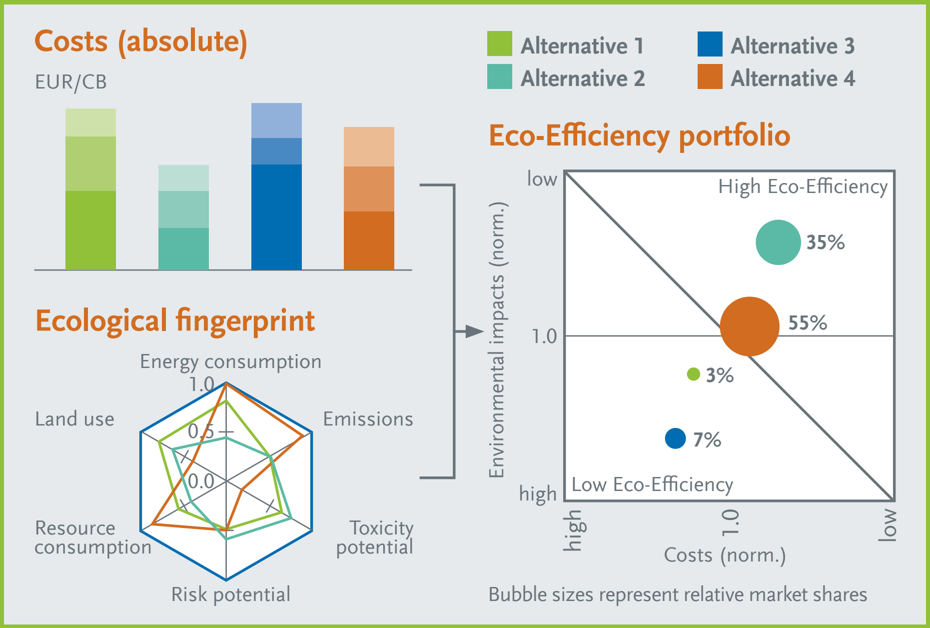
There is no general standard which prescribes or describes how to conduct an LCC or ensure comparability between different applications. Therefore, institutions conducting LCA and LCC simultaneously need to address the issue of system boundaries and time scales in order to ensure consistency and comparability. LCA has to be combined with LCC in order to cover both the economic and environmental dimension of a complete sustainability analysis.

IN PRACTICE

ECO-EFFICIENCY ANALYSIS AT BASF

BASF uses a comprehensive and science-based approach, Eco-Efficiency Analysis, to gain information about the relationship between the economic benefits of a product or technology and its impact on the environment along the whole supply chain. The LCA results for several impact categories are first normalised to generate the Ecological Fingerprint.

In a second step, environmental assessment and life cycle costing are combined in an integrated graph showing two dimensions of sustainability. It is a holistic, integrated approach that detects impacts related to a functional unit in all life cycle stages. BASF has finalised more than 450 studies of this type.



Bubble sizes represent relative market shares

Companies conducting LCC and LCA have to ensure that different departments, such as accounting, finance and environmental management, work hand in hand in order to avoid inefficient, redundant work and inconsistent data.

The combination of environmental and economic values is known as Eco-Efficiency, and will be covered by the upcoming ISO standard 14045. Eco-Efficiency can be understood as economic-ecological efficiency. It links environmental impacts with economic issues by measuring the environmental impacts per monetary unit earned.

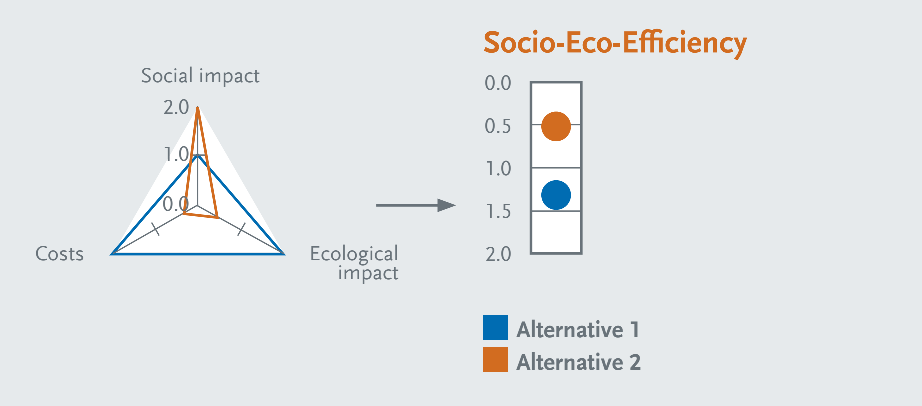
IN PRACTICE

BASF'S SEEBALANCE TOOL

BASF has developed a social life cycle assessment procedure based on the principles of the BASF Eco-Efficiency Analysis on the one hand, and a product-related specification of the social dimension of sustainability on the other hand. The new integrated instrument, called SEEBALANCE®, is applied at BASF to improve the performance of the products and processes.

SEEBALANCE® is a life cycle assessment tool that consists of three main aspects: it examines and compares the costs, environmental impacts and social effects of different product or process alternatives. Socio-eco-efficient solutions combine a relatively good environmental performance with high social benefit and at the same time low costs for the end-customer. The social criteria used in the assessment include for example work standards, employment and job creation, and working conditions in the supply chain.

The method used for the social life cycle assessment is based on an industrial sector analysis of statistical data. The final aggregation and presentation of the results is done in an analogous manner to the Eco-Efficiency Analysis.



4.7 SOCIAL LIFE CYCLE ASSESSMENT (SOCIAL LCA)

Assessing the social aspects of product sustainability is not an easy task. First, the social dimension of sustainability is a complex issue. Second, in addition to questions on assessment methods, there are very practical obstacles, such as the availability of data and the consensus on the procedure by industry and the public.

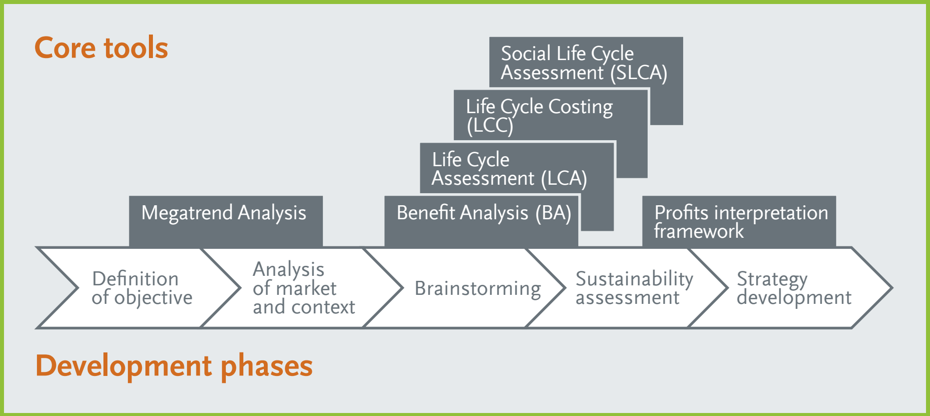
A basic problem is that many of the social aspects – such as ensuring safe working practices, provision of high-skill employment, or absence of child or forced labour in the supply chain – are qualitative aspects covered at the level of the company, rather than quantitative measures that can be attributed to individual products. Data on environmentally relevant inputs and outputs related to one product unit (usually 1 kg or 1 MJ) can be found in life cycle assessment databases, but so far there are no similar databases for social aspects.

IN PRACTICE

PROSA – PRODUCT SUSTAINABILITY ASSESSMENT

The Product Sustainability Assessment (PROSA), developed by Öko-Institut, aims to identify system innovations and options for action towards sustainable development. PROSA helps structure decision-making processes and reduce their complexity. As far as possible, the assessment builds on existing, well-established individual tools that are in common use and already deployed in most large companies and in public product policy.

Additionally, a new core tool was developed for PROSA: the Benefit Analysis. PROSA considers benefits – satisfying basic needs – to be the fourth pillar of sustainability. In Life Cycle Assessment, product benefit or utility is defined to be slightly above the functional unit or the functional equivalent. In PROSA, the benefit or utility is analysed more intensively because it ultimately determines consumers' purchase and use decisions. The benefit analysis accounts for practical, symbolic and societal utility, depending on the issue and with the help of consumer research.



4.8 A CASE IN POINT: FEEDSTOCK

A topical issue illustrating many challenges associated with product sustainability is the case of feedstock.

The chemical industry has an interest in broadening its feedstock base – for greater security of supply, sourcing flexibility, and long- term socio-economic reasons. In parallel, there is growing support from governments, companies and NGOs to move towards greater use of renewable feedstock for materials and fuel.

However, renewable feedstocks are not automatically more sustainable, and there are many challenges associated with their use that need to be overcome. At the same time, fossil feedstocks are also not without their impacts. A full sustainability assessment, using LCA and other tools, needs to be conducted to determine the optimal sourcing strategy.

4.8.1 Sustainability of feedstock

Many factors enter into play when considering the sustainability of a feedstock:

- Today, fossil feedstocks are used for the majority of chemical products, because they allow for highly efficient processing, thus minimising environmental impacts. A decision to move from one feedstock to another should be based not only on a business case, but also an at least equivalent technical and environmental **performance in processing**.

- A **cascading use** – first material use and then energetic use – can further improve the resource efficiency of both renewable and non-renewable feedstocks.

- The **sustainability of a resource** depends on various factors. Not all sourcing of a particular material or energy is equally sustainable. Each has to be assessed on its own merits and using a life cycle approach.

- Feedstock choices have impacts in many different parts of a **product's life cycle**, and may affect many different environmental aspects. Tools based on a broad life cycle approach, covering environmental (Life Cycle Assessment), economic (Eco-Efficiency Analysis) and social aspects (e.g. SEEBALANCE), help determine the most sustainable option.

In the foreseeable future, the chemical industry will continue to use a mixture of feedstocks. Fossil materials and renewable feedstocks will be used, depending on which is the more sustainable choice.

SPOTLIGHT: WHAT IS A RENEWABLE MATERIAL?

A material is considered renewable if it is wholly or partly derived from renewable resources. A renewable resource is defined as one that is produced by natural processes at a rate comparable to its rate of consumption. Materials that qualify as renewable resources are usually derived from biomass of agricultural or forest origin. Renewable energy sources include those based on sunlight, wind, biomass, tides, and geothermal heat rather than fossil fuels.

4.8.2 Challenges for renewable feedstock

Increasing the use of agriculturally derived renewable materials will result in a range of challenges that need to be overcome:

- **Competition for land**: As the global population grows to nine billion by 2050, there will be increasing competition for land for food production, urban expansion, and wilderness areas. Production of renewable materials and energy can have both direct and indirect land use impacts.

- **Impact on ecosystems and biodiversity**: Current sourcing of renewable materials such as palm oil is already linked to deforestation land use change, water pollution, loss of soil, impacts to soil, and loss of biodiversity.

- **Water availability**: Intensive production of crops will need adequate and sustainable sources of water, without causing scarcity for other uses and using techniques that reduce emissions to water.

- **Impacts on food prices**: Direct use of food crops as renewable feedstocks, and indirect impacts though competing use of farming land, could impact food availability and regional food prices. Rising food prices, causing social unrest in developing countries, have already been linked to the use of corn feedstocks for biofuels.

- **Limited resources**: Resources such phosphates, soil, and infrastructure have a limited supply.

- **Working conditions**: Given that many agricultural feedstocks are produced in developing countries, there is a need to ensure safe working conditions and respect for workers' rights.

Current research and future developments are exploring non-food crop sources for renewable materials, such as waste bio-mass (straw) and cellulose from fast growing trees, and also non-agricultural (biotech) sources, such as algae, bacteria and fungus. These technologies retain the advantages of renewable materials, while avoiding many of the challenges around land use, and impacts on food availability and prices.

4.8.3 Evaluating renewable materials for sustainability

To be sustainable, a renewable material or energy source must not be used at a rate which is greater than the environment's capacity to replenish it. This checklist helps establish whether replacing a non-renewable material with a renewable material improves overall sustainability.

The sourcing of a renewable material does not result in destruction of critical ecosystems, loss of habitat for endangered species or other negative impacts on sustainability.

When demand exceeds current supply of a renewable material or energy, the capacity to produce it may be increased to match demand. How this capacity is increased has a huge impact on its sustainability. For example, if tropical rain forests are destroyed in order to create plantations to grow a material, its production cannot be considered sustainable because it results in the rapid destruction of other natural resources that are valuable and difficult to replace.

PRACTICAL APPROACH

Use certification schemes for sustainably grown or harvested raw materials. Different schemes exist or are in development, for example the Roundtable on Sustainable Palm Oil (RSPO). These schemes offer different options for certification along the chain of custody, ranging from "book and claim" schemes to physical segregation of the raw material. They thus allow for different degrees of sustainability claims – from general statements like "Company X supports the sustainable cultivation of crop Y" to more precise like "This product is made from sustainably cultivated crop Z". Similar schemes are being developed for renewable energy from biomass. However, none of these schemes cover indirect land use change for the time being.

The use of renewable material does not otherwise increase the product's environmental impact.

The production of renewable materials and energy sources is not free from other environmental costs, such as net total energy use, net production of greenhouse gases, waste production and environmental emissions. These environmental costs can even be greater than those associated with the production of fossil-based products. For example, more fuel is used to grow, harvest and process a new material derived from agricultural plants than would be used to produce a material directly from fossil raw materials. If the substitution of a renewable material or energy source results in increases in the overall environmental footprint of a product, it cannot be considered sustainable.

The renewable material's key attributes (e.g. biodegradability) are either equivalent to or better than those of the material or energy source being replaced.

A renewable material or energy source is not guaranteed to have the same positive environmental attributes as the non-renewable resources which it may replace. For example, a surfactant derived from a vegetable oil may be poorly biodegradable, while the petroleum-derived surfactant that it replaces is readily biodegradable. In such a case, the renewable material would not be considered more sustainable.

PRACTICAL APPROACH

Conduct a life cycle assessment to assess the environmental performance of the product based on renewable raw materials and its substitute based on fossil raw materials. Sustainability analysis can also help assess the economic and social impacts of the different options.

The production of the renewable materials does not involve unacceptable social conditions, such as child labour, forced labour, unsafe working practices, or indirect negative impacts on the local population as a consequence of raw material cultivation, for example when habitats deteriorate.

PRACTICAL APPROACH

Certification systems such as the RSPO criteria for sustainable palm oil contain social as well as environmental requirements.

The production of the renewable material is cost-competitive in the long term versus alternatives.

It is key for European industry competitiveness and consumer affordability that the production of renewable materials does not result in excessive costs.

4.8.4 Evaluating fossil feedstock for sustainability

Fossil feedstock is derived from the accumulation and transformation of renewable biomass over extended periods in the life of the planet. In their current form, taking into account their available quantity and their energy content, fossil feedstocks are not renewable and therefore not sustainable as such. Indeed, their current rate of consumption is much faster than their natural production.

However, the use of fossil feedstock as raw material to produce materials can help significantly reduce the use of fossil fuels for transport, energy and heat production. Fossil feedstock can be transformed into high value materials offering unique physical properties, such as light weight, heat insulation, or flexibility. These properties are well illustrated in materials like foams, fibres, polymers, resins, rubbers, coatings, acrylics and so on, which are combined to make most of the modern materials we use in our daily life.

We therefore rely on the limited amount of highly precious resources to contribute to sustainable development through the benefits their use brings to society, economy and the environment. The fact that fossil feedstock is not renewable reinforces the need to exploit the reserves using the most efficient technologies and processes. In particular, it should be ensured that:

The sourcing of a fossil material does not result in negative impacts on sustainability.

The sustainability of fossil feedstock extraction can be improved by using technologies that limit the environmental impacts while remaining cost effective.

For instance, flaring of gases during extraction of natural gases or crude oil should be minimised using flare gas recovery techniques. The selection of drilling oils should aim to minimise residues to soil and water. The amount of energy necessary to separate the different types of fossil feedstock after extraction should be optimised.

Exploitation of bitumen and oil sands and extraction of coal should not lead to the destruction of natural ecosystems, or ecosystems should be restored after extraction. The quantity of other resources such as water and energy necessary to extract and separate fossil materials from oil sands or from coal should be minimised.

Exploitation of shale gas to produce fossil material such as ethane should be performed using techniques that do not damage the landscape and ground water reserves.

The processes used to transform the fossil feedstock maximise energy and resource efficiency.

The transformation of fossil feedstock into useful material should be performed following processes and procedures that maximise energy and resource efficiency through process yield optimisation, energy recovery stages and catalysis. In addition, processes should be designed to minimise waste, by-products and environmental emissions.

The sustainability impacts of the fossil material and potential alternatives are assessed using a life cycle approach.

When assessing the use of fossil material, it is important to identify life cycles with the highest cumulative value. Indeed, burning fossil materials as fuels is the same as moving directly to the end of the life cycle, jumping over higher-value intermediate stages.

When a fossil material has gone through the different stages of its life cycle, including several recycling loops, and when opportunities for added value recovery have been exhausted, the energy stored in the material can be recovered through combustion and heat recovery.

PRACTICAL APPROACH

Applying ad-hoc life cycle methods to assess different uses of fossil materials helps identify those with the lowest carbon footprint. For instance, many materials derived from fossil feedstock enable energy savings and thus result in a positive carbon balance. As an example, when using expanded polyester, polystyrene or polyurethanes and polymers based on poly-olefins, it is estimated that 2 to 15 tonnes of CO_2 can be saved for each tonne of CO_2 emitted during the production of the material (ICCA 2009, Denkstadt 2010).

Comparative life cycle assessments also help assess alternatives to fossil materials. Using renewable alternatives is not always feasible. For example, a study contracted by the Dutch government found that 30 percent of the surface used to grow sugar beet in the Netherlands would be required to produce 200,000 tonnes of olefins. The current olefins production capacity in the Netherlands is 4 million tonnes annually. Substituting oil and gas with renewable feed in olefins manufacturing would require 6 times the current surface dedicated to sugar beet to the detriment of sugar, food and other uses.

Social and economic criteria for the sustainability of fossil feedstock are considered similar to the criteria for renewables.

Going beyond legislation – reinforcing compliance

5

Regulation ensures that products placed on the European market are compliant in many aspects, including safety, packaging and labelling. It goes without saying that compliance with legislation is a prerequisite for industry to manufacture and supply chemicals.

Initiatives such as Responsible Care and companies' Corporate Social Responsibility programmes are examples of how industry goes beyond existing regulations.

5.1 RESPONSIBLE CARE

For over twenty years, the global chemical industry's Responsible Care initiative has provided an overarching framework to continuously improve the safety, health and environmental performance in the sector. This applies to manufacturing activities, logistics and the use of chemical products, and goes beyond the existing regulatory framework.

Responsible Care encourages industry to:

- Share **best practices** along the whole value chain
- Establish **common principles** for operating as a sustainable and ethical sector
- Promote **dialogue** between the industry and the community at large

Key achievements of Responsible Care include regular reporting and verification. These achievements help render industry performance more accessible and transparent, thereby supporting stakeholder engagement and asserting industry's credibility as a sustainable and dependable sector.

The Global Product Strategy (GPS) developed by the International Council of Chemical Associations (ICCA) is one example of how the chemical industry has advanced its product stewardship performance by measuring and communicating about chemical hazards, risks and safe handling along the value chain.

SPOTLIGHT: RESPONSIBLE CARE GLOBAL CHARTER

The core principles of the Responsible Care Global Charter cover sustainability, certification and transparency aspects, committing the chemical industry to:

- Continuously improve the environmental, health, safety and security knowledge and performance of our technologies, processes and products over their life cycle so as to avoid harm to people and the environment.
- Use resources efficiently and minimise waste.
- Report openly on performance, achievements and shortcomings.
- Listen, engage and work with people to understand and address their concerns and expectations.
- Cooperate with governments and organisations in the development and implementation of effective regulations and standards, and to meet or go beyond them.
- Provide help and advice to foster the responsible management of chemicals by all those who manage and use them along the product chain.

5.2 CORPORATE SOCIAL RESPONSIBILITY (CSR)

Corporate Social Responsibility (CSR) is a form of self-regulation whose goal is for the organisation to embrace responsibility for all its actions and encourage a positive impact through its activities on the environment, consumers, employees and communities. It positions the company as key actor in society, not limiting its role to “charity” or local community involvement.

Key CSR issues relevant to product evaluation include:

- **Consumer issues**: For instance, a minimum requirement is to always ensure product safety.

- **Labour practices**: Chemical industry activities not only provide direct employment opportunities, but also indirect jobs in fields such as logistics, construction, human resources and IT, and even in the “social economy”, for instance in waste treatment operations. In all these, the International Labour Organization’s recommendations should be followed, for instance the universal freedom of association or the interdiction of child/forced labour.

- **Human rights**: This refers to the formal commitment of the industry or organisation to respect human rights locally and at the international level.

- **Ethical practices**: In particular in fields such as biodiversity, biotechnologies and pharmaceuticals, it is crucial to ensure recognition, reward and fair share of benefits arising from the utilisation of genetic resources in an equitable way, both locally and at the international level. This includes issues such as access, transfer of relevant technologies, and appropriate funding.

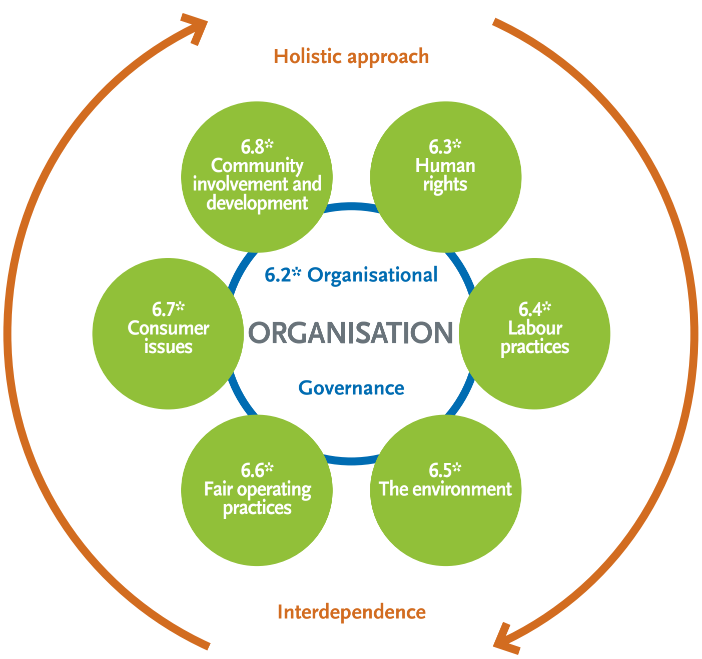
- **Environmental impacts** of activities and products should be continuously assessed and conclusions spread along the value chain.

- **Community involvement**, especially at local level, should be encouraged. This applies to job creation, but also for example information-sharing with the local community.

Several points are worth noting:

- The above elements are clearly interdependent and actions on one of them influence the overall performance.
- Social aspects are often qualitative rather than quantitative and difficult to "allocate" to one product or product line of a sector, an organisation or a company.
- The scope of the CSR is also important. Companies can act at the individual level or promote collective approaches at a sector or specific geographical level.

ISO social responsibility standard: 7 core subjects



* The figures denote the corresponding clause numbers in ISO 26000

5.3 INITIATIVES BY RETAILERS AND OTHER STAKEHOLDERS

In the coming years, compliance may take different forms as parts of the sustainability jigsaw fall into place.

Currently, some downstream users are promoting voluntary schemes such as environmental management and audit schemes (EMAS, ISO14001), the EU Ecolabel and Green Public Procurement (GPP) schemes as ways to encourage organisations to demonstrate the environmental credentials of their facilities and products. Separately, leading global retailers are developing schemes to ensure that their suppliers consider the three pillars of sustainability throughout their supply chains.

These schemes create additional pressure on companies to generate data and so a good dialogue across the value chain is necessary. It is vital that industry continues to promote the use of sound science and proportionality as the foundation of any voluntary schemes. Cefic continues to work with all stakeholders to ensure that industry is made aware of new tools and processes in order for companies to keep abreast of new developments that could affect their operations.

SPOTLIGHT: STAKEHOLDER SUSTAINABILITY INITIATIVES

Walmart's Sustainability Index includes a supplier sustainability self-assessment to evaluate impacts on:

- Energy and climate
- Materials
- Efficiency
- Nature and resources
- People and community

EcoCert certifies an organisation's processes to establish compliance with international standards like ISO14001.
The audit process includes:

- Sourcing
- Manufacture
- Distribution

SEDEX (Supplier Ethical Data Exchange) is an information exchange tool through which suppliers and customers can view sustainability information. This information can be shared on a 'one to many' basis, removing the need for multiple questionnaires or audit programmes. SEDEX focuses on the environmental and ethical aspects of sourcing and manufacturing.

COSMOS (COSMetics Organic Standard) aims to stimulate sustainable consumption and production of cosmetics through:

- Responsible use of natural resources
- Processing and manufacturing that are respectful of human health and the environment
- Integrating and developing the concept of green chemistry

TO DO LIST

☒ Encourage life cycle thinking

Conducting a full Life Cycle Assessment (LCA) can be a time-consuming and expensive business, but taking a life cycle approach by considering all stages of your product or service's life cycle can lead to new insights. There are many LCA studies available in the public domain that can help you get started in life cycle thinking.

☒ Engage with your customers and suppliers

Understand your customers' needs and what your suppliers can offer in terms of innovative products.

☒ Understand exactly where your product or service adds value

How can you maximise this value? Is there a way you could deliver that benefit in a different way, using fewer materials or less energy?

☒ Know where the environmental hotspots are

for your company, your products or your services. Do the major impacts arise from your operations, your supply chain or from the use of your products? Knowing where the hotspots are will help you identify strategies to reduce them.

☒ Measure, monitor and manage

Do you currently measure your energy, and water consumption and emissions of CO_2 and waste? Having the data allows you to identify where you can target efforts and reductions, and in many cases this will lead to cost savings.

☒ Turn a waste into a resource

Identify all of the materials that leave your operations as waste, and look to see which of them may be of value in another process. Taking a systematic approach may identify materials that can be sold as a secondary raw material, turning a waste into a resource, and a cost into a revenue stream.

☒ Keep up to date with upcoming policy and regulatory requirements

Cefic and national associations can help you anticipate new policies and regulations, to shape your future business strategy.

☒ **Use sound science** in your business decisions and in your advocacy efforts.

☒ Ensure transparency

By providing credible information on data used to estimate the life cycle of your product, you will gain confidence from your stakeholders.

Glossary

Biodiversity
The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (Convention on Biological Diversity, United Nations, 1992).

Carbon footprinting
A methodology to calculate (as opposed to measure) the greenhouse gas emissions associated with providing a particular product or service, normally over the whole life cycle.

Circular economy
A policy approach to promote the re-use, recovery and recycling of materials after use, to reduce the consumption of virgin resources and minimise end of life disposal.

Cradle-to-cradle
Promotes the principle that products can be designed from the outset so that, after their useful lives, they will provide nourishment for something new. This could be either as a biological nutrient that will easily re-enter the water or soil without depositing synthetic materials and toxins or as technical nutrients that will continually circulate as pure and valuable material within a closed loop industrial cycle.

Cradle-to-grave
The full life cycle of a product that is considered in a life cycle assessment, including raw material extraction, manufacture, packaging, distribution, use and post-use recovery or disposal. This has been further refined to "cradle-to-cradle" by McDonough and Braungart, to focus on reuse and recovery of materials after use, in line with the concept of a "circular economy".

CSR
Corporate Social Responsibility, or "the responsibility of enterprises for their impacts on society" (European Commission, 2011).

Down-cycling
Recycling of materials after use, where the secondary use is considered of lower value than the original use.

Eco-efficiency
A concept developed by the World Business Council for Sustainable Development (WBCSD) in 1992 based on creating more goods and services while using fewer resources and creating less waste and pollution. The Eco-Efficiency Analysis developed by BASF is a tool for assessing products and processes on a comprehensive and comparative basis.

Ecolabelling
Schemes for communicating environmental information and encouraging purchase of products or services with particular environmental attributes. Schemes can be voluntary, such as the EU Ecolabel scheme, or mandatory, such as the energy labelling scheme, and run by public or private bodies or NGOs. Ecolabelling is covered by ISO standards in the ISO 14020 series.

Ecosystem
A dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit (Convention on Biological Diversity, United Nations, 1992).

Environmental Product Declaration
EPD is a standardised (ISO 14025/TR) and LCA based tool to communicate the environmental performance of a product or system, and is applicable worldwide for all interested companies and organisations.

EMAS
Environmental Management and Audit Scheme of the EU, similar in intent to the global ISO 14001 Environmental Management System Standard.

Functional unit
The unit of comparison in a Life Cycle Assessment (LCA), which describes the value provided. All impacts over the life cycle are allocated to delivering the functional unit. For example, the functional unit for a comparison of transport options could be "per person kilometre travelled."

Global Product Strategy (GPS)
Designed by the International Council of Chemical Associations (ICCA) to reduce existing differences in the safety assessment of chemicals between developing, emerging and industrialised countries. It establishes a base set of hazard and exposure information adequate to conduct safety assessments for chemicals in commerce, provides global capacity building to implement best assessment practices and management procedures, especially with small and medium sized companies and in developing countries, shares relevant product safety information with co-producers, governments and the public, works across the value chain so suppliers and customers can effectively evaluate the risks and successfully manage chemicals through their life cycles, and makes information on chemicals publicly available.

Green Public Procurement (GPP)
Public policy tool to encourage the procurement of products that meet certain environmental standards by public authorities.

Land use change
The change from one form of land use to another. An example of so-called direct land use change (LUC) would be clearing a forest to cultivate crops. A change in the use of existing arable land resulting in direct land use change someplace else is referred to as indirect land use change (ILUC). An example would be the cultivation of crops for biofuels in Europe displacing the cultivation of animal feed to other countries, resulting in land use change there.

Life Cycle Assessment (LCA)
Environmental management tool that assesses the overall environmental performance of a particular product or service. LCA considers the whole life cycle, from cradle to grave, and a wide range of impact categories. LCA is defined by various ISO standards (ISO 14040 series).

Life Cycle Costing (LCC)
A concept under development at the EU level; includes all the costs incurred during the life cycle of a product.

Life Cycle Impact Assessment (LCIA)
One stage in a Life Cycle Assessment, in which the life cycle inventory of material and energy inputs and outputs are converted into potential impacts.

Life Cycle Inventory (LCI)
One stage in a Life Cycle Assessment, in which the individual material and energy inputs and outputs associated with delivering a product or service are calculated and aggregated.

Life cycle thinking
An approach that considers the environmental impacts associated with providing a product or service, from cradle to cradle (i.e. from the extraction of resources, through the manufacture and use of the product, to the final processing of the disposed product). A less structured process than a full LCA, but can provide valuable insights.

NGOs
Non-Governmental Organisations.

Resource efficiency
A general concept currently promoted by the EU as part of its Europe 2020 strategy to achieve sustainable growth; includes the efficient use of resources and a low carbon economy.

Raw materials
Raw material or feedstock is the basic material from which a product is manufactured or made.

Responsible Care®
The global chemical industry's initiative to continuously improve its health and environmental performance, enhance security, and communicate with stakeholders about products and processes.

REACH
EU chemicals regulation dealing with Registration, Evaluation, Authorisation and Restriction of Chemical Substances.

Risk assessment
Tool to assess risk and safety for humans and/or the environment. Consists of two parts: hazard assessment, which looks at the toxicity of the material and the dose at which an effect is observed, and exposure assessment, which predicts the likely concentration of the material that will be encountered. Risk assessment, unlike Life Cycle Assessment, is site and time specific, so can be used to assess safety.

Sustainable Consumption and Production (SCP)
The use of services and related products which respond to basic needs and bring a better quality of life while minimising the use of natural resources and toxic materials as well as the emissions of waste and pollutants over the life cycle of the service or product so as not to jeopardise the needs of future generations (United Nations Conference on Sustainable Development, 1995).

SEEBALANCE®
Comparative life cycle assessment tool from BASF that integrates cost, environmental and social impacts of a product or process.

Up-cycling
Recycling of materials after use, where the secondary use is considered of higher value than the original use.

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Annex

How Sustainable Development builds on Responsible Care and CSR

Sustainable Development gives the broad context of the vision of the chemical industry in society, building on collective industry programmes (Responsible Care, Global Product Strategy) and individual companies' programmes (Corporate Social Responsibility). As such, the scope of Sustainable Development is broader and goes beyond guidance to membership.

	SUSTAINABLE DEVELOPMENT	RESPONSIBLE CARE	CORPORATE SOCIAL RESPONSIBILITY
WHAT	Contribution of (chemical) **industry** to society worldwide	**Chemical** industry specific improvements (products, processes)	**Voluntary** process to enhance the contribution of (chemical) **companies** to society
WHEN	Long-term view taking into account future generations' needs	Yesterday, today and tomorrow timeframe	Yesterday, today and tomorrow timeframe
HOW	Fair framework **balance** between: • Economy • Environment • Social aspects • Communication to a broad public supported by GRI and third parties' sources	**Industry specific** national programmes • Environment, Health and Safety (EHS) • Security • Product Stewardship (value chain) / Global Product Strategy • Communication to a broad public supported by companies' and federations' data sources	**Reporting** / contribution of (chemical) companies to society • Economy • Environment • Social aspects & ethics • Communication to a broad public by companies without harmonised legal requirements
WHO (AND TO WHOM)	• Society at large • Key political leaders • Key stakeholders • **Broad alliances** and consortia along the value chain	• Management • Employees • National, regional and global chemical associations and companies • Key stakeholders	• Management / staff • Key stakeholders • Political leaders • **Along the value chain**
WHERE	Broader **industry** across supply chain globally	Worldwide **chemical** industry	Local, national, European and worldwide

To learn more about
the European chemical
industry's sustainability
vision and initiatives,
download our
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Chemistry – simply essential for a sustainable future

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