




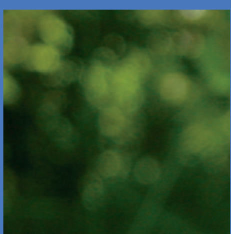



Öko-Institut e.V.
Institut für angewandte Ökologie
Institute for Applied Ecology

PROSA –
Product Sustainability Assessment

PROSAplus Guideline

Product Sustainability Assessment PROSA Produkt-Nachhaltigkeits-Analyse

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Öko-Institut e.V. –
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PO Box 500240
D - 79028 Freiburg
Phone: 0049 - 761 - 45295-0
Email: info@oeko.de
www.oeko.de
www.prosa.org

Authors
Martin Möller
Florian Antony
Rainer Grießhammer
Jens Gröger
Rasmus Prieß

Layout
Tobias Binnig – gestalter.de

Dieser Leitfaden ist auch in deutscher Sprache verfügbar. This guideline is also available in German.

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The joint project was carried out by the ZNU – Centre for Sustainable Leadership at the University of Witten/Herdecke (project management) in cooperation with Oeko-Institut e.V. The project team consisted of Dr Ulrike Eberle (project management), Julius Wenzig, Dirk Pieper (all ZNU) and Martin Möller (deputy project management), Rasmus Prieß, Jens Gröger, Dr Florian Antony (all Oeko-Institut) and Prof. Dr. Rainer Grießhammer.

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1 PROSA in brief

New challenges

Strategic product portfolio planning, product development and product marketing have become more complicated. Digitalisation, targeted transformations such as the transition in the energy sector, global markets with diverse cultures and rapidly changing consumer attitudes present a need to deploy integrated prospective management methods in the development of products and services. The growing influence of social framework conditions is a further reason for using such tools. This setting includes statutory requirements such as Socio-Economic Benefit Analysis under the European Union's chemicals law in the shape of REACH and the MEEuP integrated assessment method required by the EU Eco-Design Directive. In addition, market-driven elements such as financial rating and voluntary agreements such as corporate reporting are playing an increasingly important role, but also the sharp eye of NGOs and the media on the social acceptability of production processes in countries of the global north and global south is decisive.

Very few methods to tackle these new challenges have yet been developed which are clearly characterized and proven in practice. PROSA is one such method. PROSA gives particular attention to the analysis of social and societal aspects, and to the consideration of utility aspects and consumer research. In the process of developing the individual tools that make up the method, care was taken to engage in close international exchange and harmonization, for instance with SETAC on Life Cycle Costing, with UNEP-SETAC on Social LCA and with major industrial companies on application in practice. The present PROSAplus manual (as of January 2021) presents the state of the art of the PROSA method (update of the initial version from 2007).

PROSA (Product Sustainability Assessment)

is a method for the strategic analysis and evaluation of product portfolios, products and services. The goal is to identify system innovations and options for action towards sustainable development. PROSA structures the decision-making processes that this requires, reducing complexity to key elements.

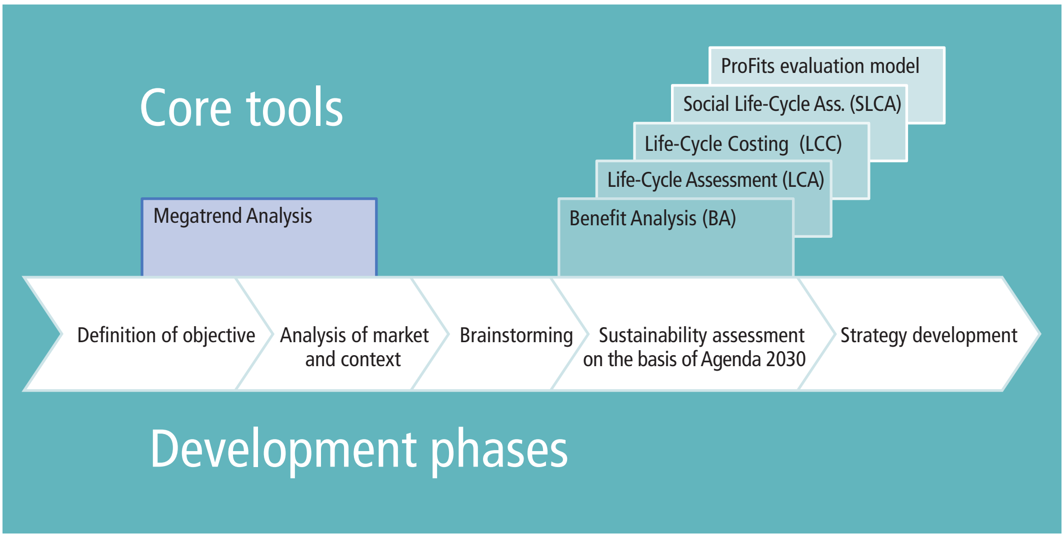
Important fields of application include:
- Strategic planning and product portfolio analysis in companies,
- product development and marketing,
- product policy and dialogue processes,
- sustainable consumption and product information.

Thanks to the open structure, PROSA can also be used to analyse sustainability at other levels, such as technologies or companies.

PROSA spans complete product life cycles; it assesses and evaluates the environmental, economic and social opportunities and risks of future development trajectories. PROSA is a process-driven and iterative methodology which gives due regard to time and cost restrictions. It calls as far as possible on existing, well-established individual tools: Megatrend Analysis, Life Cycle Assessment (LCA), Life Cycle Costing (LCC), Social Life Cycle Assessment (SLCA), supplemented by the Benefit Analysis developed by Oeko-Institut. A new feature of PROSAplus is the well-founded and predefined selection of sustainability indicators based on the 2030 Agenda.

Figure 1 shows the basic structure of PROSA.

Figure 1: Basic structure of PROSA



The sequence of work is guided by the typical phases of strategy formulation processes. The so-called **Pathfinder** structures the implementation of PROSA.

PROSA is an open-ended methodology that does not predefine outcomes. It places a particular focus on the evaluation process and on evaluation models. Prevailing normative disparities and conflicts among individual stakeholders, cultures and (world) regions as well as changing social values are identified clearly – as are potential approaches towards common innovation. PROSA moderates, in a targeted manner, opposing interests and decision-making situations that arise in corporate product development or in product policy and dialogue processes.

The following elements are seen as mandatory elements of PROSA:

- Focus on system innovation,
- clear process management (“Pathfinder”),
- benefit analysis,
- inclusion of the complete product line,
- analysis of sustainability aspects on the basis of the 2030 Agenda.

In the following, this manual explains how to use PROSA and illustrates the method with case studies.

As a further development of the PROSA method, PROSAplus offers a number of advantages in its application, because the instrument

- acts as a strategic radar for opportunities and risks,
- identifies future markets and new consumer needs,
- takes account of present and future societal settings,
- helps to avoid misinvestments,
- inspires by relaying the views and values of different stakeholders, regions and cultures,
- highlights and reduces complexity to the essentials and sets clear priorities.

2 Pathfinder

Product sustainability assessments present major challenges. These challenges will be mastered successfully and efficiently if work procedures and decision-making processes have a clear and well-reasoned structure – which, in PROSA, is imposed by a special process tool called the Pathfinder. The Pathfinder specifies the way PROSA is carried out – the chronological sequence, the selection of (core) tools – and provides aids such as indicator lists, time and cost management structures, graphics routines and interpretation frameworks.

The Pathfinder sets out the prototypical performance of PROSA (cf. figure on the right). When used by companies, the company's own specific management tools, checklists or interpretation frameworks can be used readily. A strategy team should be formed within the company to carry out or support PROSA.

The sequence of the process is guided by the typical phases of strategy formulation processes: definition of objective, analysis of market and setting, brainstorming, evaluation and strategy formu-lation. The performance of PROSA is process-led and iterative – initial, orienting analyses are pursued in greater depth later on, new ideas or unexpected findings can change the course of the process or can cause previous phases to be reworked.

Core tools and new tools
A set of core tools is used to support work in the individual phases. Most of the tools are mature and in common use. They are already deployed in most large companies and in public product policy. These include megatrend analysis, consumer research and Life Cycle Assessment (LCA). Three new core tools were specially developed for PROSA: Social LCA (together with the UNEP-SETAC Life Cycle Initiative), Benefit Analysis and the ProFitS (Products Fit to Sustainability) assessment software.

Process-led and iterative
Depending upon context, certain tools can gain greater or lesser importance or can prove to lack relevance in the specific case. Conversely, other tools can be used without difficulty when they are required – a "joker" is placed to mark the position of such special tools in the process. Such tools may include safety analyses for facilities where major accidents are an issue, (eco)toxicological risk assessment, noise studies, pre-investment appraisals etc. PROSA is used to select and determine the depth of analysis of the different tools and indicators, and it ensures integration of the various findings.

The assignment of individual steps and tools to specific phases is to be understood as a recommendation. Depending upon context, the steps are carried out in different depths. Core tools can also be applied in other or several phases of the PROSA process. For instance, evaluation takes place in the last phase, but important pre-evaluations already take place in the first phases – when deter-mining the goal, identifying stakeholders, prioritizing ideas and selecting indicators. Departures from the recommended or planned sequence of work are possible without further ado – but they should be decided upon and reasoned clearly.

The next sections of this manual present in detail and explain with case studies the following tools and the selection of indicators:

- Life Cycle Assessment,
- Life Cycle Costing,
- Eco-Efficiency Analysis,
- Social LCA,
- Benefit Analysis,
- Selection of sustainability indicators based on the 2030 Agenda,
- Evaluation and aggregation,
- The integrated interpretation framework and
- ProFitS software.

The Product Portfolio Sustainability Analysis is presented at the end of this brochure, as it represents a special use case of PROSA in companies. If such a Product Portfolio Analysis is carried out, it is of course at the beginning of the investigation.

The annex to this brochure contains several checklists and overviews designed to aid the performance of PROSA. These can readily be substituted by company-specific checklists where such exist:

- "Actors" checklist,
- "Stakeholder involvement" checklist,
- "Opportunities and risks arising from cooperating with actors" checklist,
- "Integration of the sub-methods in PROSA" checklist,
- List of social indicators.

Figure 2 – Sequence of PROSA and tasks of the individual phases

Phase	Task and outcome of phase	Tools and aids
Definition of objective	Concretize the task and capacities (human and financial) and set schedule	
	Carry out internal and external actor analysis and clarify involvement of internal and external actors (companies, stakeholders)	Actor Analysis Stakeholder Involvement Checklist Actor Cooperation Checklist
	Select priority product fields	Product Portfolio Analysis
Analysis of market and context	Comprehensive characterization of the product and its setting (society, market, technology, country or region etc.), where appropriate synopsis of conceivable system developments in consistent scenarios	
Brainstorming	Collect visions, ideas, product or system alternatives. Prioritize these for the assessment phase	
	Adoption of the product- and company-related sustainability indicators and the benefit indicators of the 2030 Agenda.	Indicator List
	If necessary, expand to include more detailed indicators.	
Sustainability assessment	In-depth sustainability assessment	Integration Checklist
	Analyse environmental aspects throughout the product life cycle	Life-Cycle Assessment (LCA)
	Analyse economic aspects throughout the product life cycle	Life-Cycle Costing (LCC)
	Analyse social/societal determinants throughout the product life cycle	Social LCA (SLCA)
	Identify consumer groups and their needs and utility demands	Consumer Research Benefit Analysis
	If required, assess further or other aspects using special tools such as safety analyses, toxicological analyses, noise studies etc. ("Joker" to mark the position of such tools in the process)	Joker
Strategy planning	Derive development paths and concrete strategic options for action and subsequently evaluate these. The evaluation includes a benefit-sustainability appraisal and an examination whether minimum sustainability criteria are complied with. Options for action can also relate to communication or re-organization (modification of strategy or of the organization, organizational learning etc.).	ProFitS" (Products Fit to Sustainability) integrated interpretation framework and partial evaluation frameworks for individual dimensions.

3 Life Cycle Assessment (LCA) as original method

The implementation of Life Cycle Assessments is described in detail in the ISO standards 14040 and 14044, LCA being a widely known and proven methodology. In many companies, it is used for product development, in politics for some product-related legislation (such as the Ecodesign Directive and the Packaging Act), and for consumer information and product labels. The basic structure of the LCA comprises four phases (goal and scope definition, inventory analysis, impact assessment and interpretation; see ISO 14040). The other core tools of PROSA such as Life Cycle Costing (LCC) and Social Life Cycle Assessment (SLCA) as well as the integrated product sustainability analysis employ the basic methodological approach of LCA as directly as possible or, where necessary, in a modified form.

The methodological description of the LCA can be dispensed with at this point due to the existing standards. Prospective LCAs pose a particular challenge because here it is necessary to use a larger number of assumptions with a comparably high level of uncertainty. The following comparison of electric cars with petrol and diesel cars shows on the one hand the efficiency of the LCA method, and on the other hand the great importance of well-founded assumptions and data as well as sensitivity calculations.

3.1 Comparison of electric cars with petrol and diesel cars

The aim of this LCA is to compare classic petrol and diesel cars with battery electric vehicles (hereinafter referred to as 'electric cars') in terms of their contribution to climate change mitigation, in each case in relation to new cars. The results serve as a basis for product- and mobility-related decisions as well as for consumer decisions. Thereby, it is generally assumed that alternative forms of mobility (long-distance rail, public transport, cycling, car sharing) have already been considered or exhausted, and that the purchase of an own car is considered necessary.

The following alternatives were not included in the comparison:

- Plug-in hybrid vehicles, because these are predominantly driven like classic cars, i.e. with a high proportion journeys with petrol- or diesel-powered vehicles, mainly with company cars, but also with private cars;
- Fuel cell cars, because these only have advantages for frequent long-distance journeys and there are hardly any vehicles available on the market anyway;
- petrol or diesel cars powered by "CO_2 neutral" power-to-X fuels, because this combination has a very high demand for renewable electricity compared to battery electric cars. In addition, CO_2 emissions can be even higher than with (fossil) diesel or petrol if the electricity does not come from additional renewable sources.

The following framework conditions apply to the comparison: The country of accounting (for the use phase) is Germany, production is globally distributed. The German electricity mix is used as the basis for the electricity supply in the use phase. It is assumed that renewable energies are increasingly used in the production of electricity (increase of the share to 65 % by 2030 in accordance with the German Government's Climate Action Programme). It is also assumed that the network of electric charging stations will be sufficiently expanded in the coming years. The construction of the network and the (earlier) construction of the current filling station network are not accounted for (cut-off criterion).

Given that there are well over a thousand different car models, the comparison is made using a case study, namely the most frequently sold car model in Germany: the VW Golf. As regards electric cars, the **VW ID.3 Pro Performance** (electric car with 58 kWh battery) is most similar to the Golf. The diesel and petrol versions most similar to the ID.3 are the **VW Golf 1.5eTSI Life DSG** (petrol car) and the **VW Golf 2.0 TDI SCR Life**.

The different benefit aspects are discussed in chapter 7 (Benefit Analysis). In the case of the ID.3, the variant with a higher battery capacity (i.e. 58 kWh battery) was chosen because this is associated with a greater range and is increasingly in demand.

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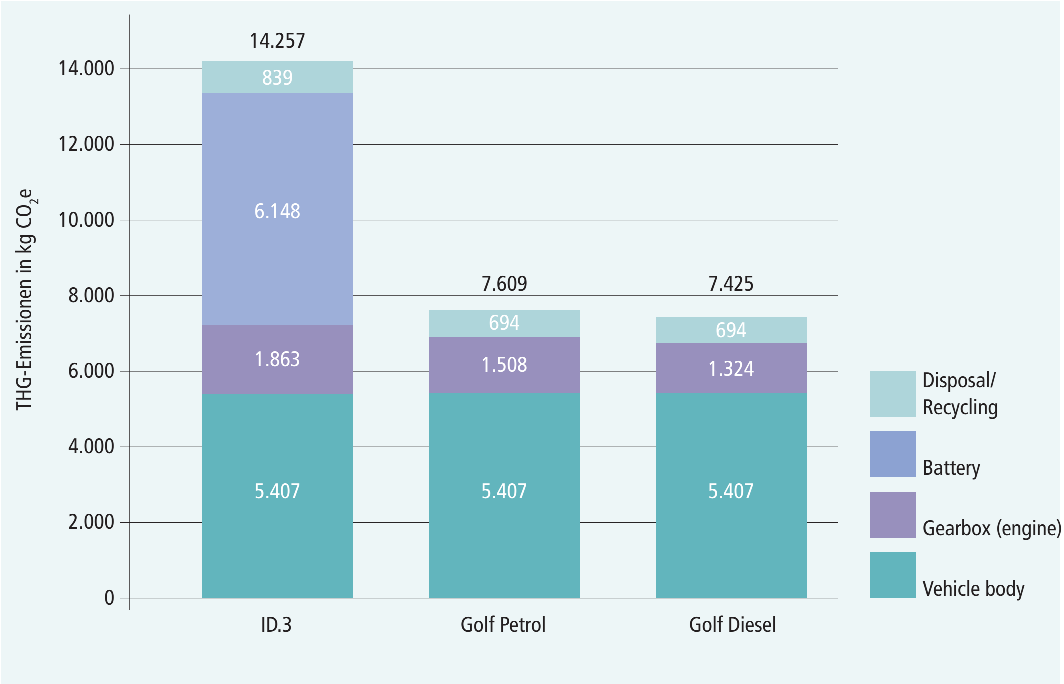
When balancing the production and recycling of passenger cars, existing and generally recognised LCA data can be used for the "vehicle body". The vehicle body accounts for the largest share of greenhouse gas emissions during production expressed in CO_2 equivalents or CO_2e. In the case of diesel and petrol passenger cars, the following parts are added to the vehicle body in the LCA: Combustion engine, gearbox, additional components (e.g. fuel tank), exhaust system and starter battery. For the electric car, the following parts are added instead: Electric motor, (smaller) gearbox, various additional components for the electric drive train (e.g. high-voltage cables, charging electronics, inverter/converter) and above all a large battery (in the case of the ID.3, a lithium-ion battery, the production of which causes particularly high greenhouse gas emissions (see Fig. 3)). The recycling of the ID.3 is somewhat more complex than that of the Golf diesel or Golf petrol.

Figure. 3 - Greenhouse gas emissions of vehicle production and disposal by comparison



Source: Own calculations according to Agora and IFEU

The production of the ID.3s is significantly more CO_2-intensive (around 100 kg CO_2e per kWh of battery capacity), especially due to the battery. The data on the production of the battery differ considerably, and there is currently (as of 2020) only a small amount of reliable primary data available. There are several reasons for this: Battery development is comparatively new, manufacturers are competing with different battery systems, production data is therefore partly secret, and dynamic technical development and upscaling are reducing CO_2e emissions per kWh of battery capacity. A lot of electricity is used in the production of the battery, so that the total emissions of battery production also still depend significantly on the electricity mix of the manufacturing country.

In a meta-study conducted by Agora Verkehrswende, 23 studies on battery production were evaluated. The data on CO_2e emissions per battery capacity ranged from about 40 to 270 kg/CO_2e. The average of the ten more recent studies (as of 2016) was around 130 kWh. Agora Verkehrswende assumed an average value of around 145 kg CO_2e/kWh after a detailed evaluation. A more recent Swedish study reported a range of 61 - 106 kg CO_2e/kWh (Emilsson & Dahllöf 2019). In the following, the higher value of 106 kg CO_2e/kWh from the Swiss study is used as a basis. For the production of a 58 kWh battery this corresponds to 6,148 kg CO_2e/kWh, for a smaller 35 kWh battery only to 3,710 kg CO_2e/kWh.

For the use phase, a holding period of 12 years and a total mileage of 180,000 kilometres or 15,000 kilometres per year are selected as the functional unit. This assumption on the annual mileage of private owners is a compromise: petrol cars drive on average about 10,400 kilometres; diesel cars, on the other hand, about 17,400 kilometres; electric cars about 11,500 kilometres (of course, there is no long-term experience here yet). Car-sharing cars and taxis have much higher annual mileages – up to 70,000 kilometres.

The consumption values of electricity, diesel and petrol per 100 km are based on the standard values stated by the manufacturers according to the WLTP test (the real values are higher).

While the CO_2e emissions for petrol and diesel are constant in a first approximation, even in perspective, very different, time-related assumptions can be made for electricity:

- Current household electricity mix (electricity mix of the year 2020);
- Average over the period of use (as assumed) and thus of the average electricity mix over the next twelve years (because, according to the federal government's plans, the CO_2e emissions per kWh decrease each year due to the increase in renewable energies);
- Assumption that the electric cars are predominantly charged at private or commercial photovoltaic systems (with very low CO_2e emissions);
- Assumption that the electric cars are predominantly charged at night (with a then higher share of coal-fired electricity and correspondingly significantly higher CO_2e emissions per kWh).

In a complete LCA, usually up to 16 impact categories are analysed. Since the objective of the LCA presented is to analyse only the climate relevance, the comparison is limited to the greenhouse gas emissions along the life cycle (raw materials, production of the passenger car, production of electricity or diesel and petrol, use and recycling and disposal of the car).

The Life Cycle Inventory (Tab. 1) shows that, with the assumptions described, the ID.3 produces significantly lower CO_2e emissions overall than diesel or petrol cars. The higher CO_2e emissions caused by the battery production of the ID.3 are compensated for after about 80,000 kilometres of driving (with the smaller 35 kWh battery already after about 60,000 kilometres).

Other advantages of the ID.3s not included here are the significantly lower noise levels in the city (at higher speeds, tyre noise dominates with all passenger cars) and that there are no pollutant emissions in the city (except for the usual tyre abrasion of all passenger cars).

Table 1 – Comparison of greenhouse gas emissions in production and use

	ID.3 per performance 150 kW (58 kWh battery)	Petrol Golf VW Golf 1.5 eTSI Life DSG	Diesel Golf Golf VIII 2.0 TDI SCR Life DSG
	Emissions (kg CO_2e) per 180.000 km and 12 years		
Car production & disposal (kg CO_2e)	14.257	7.609	7.425
Production & use of electricity/diesel/petrol	12.640	28.728	24.536
Total	**26.897**	**36.337**	**31.961**
Assumption			
Consumption/WLTP per kWh/100 km (incl charging losses) or per litre/100 km)	15,4	5,7	4,3
Greenhouse gas emissions per kWh (average of the period of the years 2020 - 2031) or per litre (according to DIN 16.258)	0,456	2,8	3,17

Sensitivity analyses can be used to examine the extent to which other assumptions would have an impact. For reasons of space, this is only presented qualitatively below:

The comparison shifts partially or completely in the direction of the Golf diesel/petrol under the following assumptions:

- Consideration of production only,
- assumption of larger batteries (and larger cars),
- significantly higher values for battery production,
- only a small total mileage or consideration of the first years after purchase only (e.g. 3-5 years),
- charging of electric cars only or mainly at night.

The ID.3 performs even better under the following assumptions:

- Use of a smaller battery,
- even higher mileage,
- charging mainly during the day,
- and very clearly: charging predominantly at the (own) PV system.

The sensitivity analyses also show how the replacement of an electric car can be optimised from an environmental point of view: as small a car as possible, as small a battery as possible, charging as often as possible during the day and as much as possible on one's own PV system.

3.2 Interpretation models to capture aggregate environmental impact

LCA according to ISO 14040 and ISO 14044 captures the most varied types of resource consumption (e.g. energy carriers, minerals, or water) and environmental impact in the form of impact categories (greenhouse gases, acidification, eutrophication etc.) and reports these in relation to a functional unit as "**inventory results**". This is followed by the **Impact Assessment** as an evaluation of potential environmental impacts. Individual Life Cycle Inventory results (e.g. emissions of CO_2 and methane) are classified and assigned to impact categories (e.g. greenhouse effect) and characterised or weighted according to their specific contribution per kilogram (e.g. to kg CO_2 equivalents). According to the ISO standard, the **interpretation** then takes place as an evaluation of the impact assessment with regard to the goal and scope of the study. For this purpose, further sub-steps (optional according to the ISO standard) can take place – a normalisation to comparable values (e.g. to national emissions or legally permitted emission quantities), similar effects can be grouped (grouping) or their significance or weight assessed (weighting).

ISO Standards 14040/14044, however, prohibit such overall **aggregation** if different product alternatives are to be compared and published. This feature of the ISO standards stands in the way of practical application – in practice, aggregation to an expression of overall environmental impact must take place outside of the LCA in formal terms if the process is to conform to the standards.

In practice, aggregations are often used, especially when several products or alternatives are compared. For reasons of practicability and integration into an overall assessment, it is advisable to work with assessment models that allow aggregation into an overall environmental impact. An overall environmental indicator is particularly necessary, however, if an eco-efficiency analysis is to be carried out (see p. 17) or if a larger number of economic and social aspects are also considered in the context of a sustainability assessment. Even if an overall aggregation is carried out, however, recourse to the basic data of the results of the impact assessment on the individual environmental impacts should always be ensured for reasons of transparency and traceability.

Numerous companies have their "own" environmental assessment models, at least internally; only a few, such as BASF with its eco-efficiency analysis (Saling 2016), publish their assessment approach. The PEF aggregation model presented by the EU Commission as part of its "Product Environmental Footprint" strategy, on the other hand, offers the opportunity for an overarching, uniform assessment. For PROS, it is therefore recommended to use this aggregation model. Another assessment model can be used, but the PEF aggregation model should then be supplemented as a sensitivity analysis.

3.3 Product Environmental Footprint (PEF) and aggregation model

In 2013, the European Commission published the product-related strategy "Product Environmental Footprint" (PEF). The aim is to standardise the Life Cycle Assessment analysis and evaluation of products as far as possible. The background to this was the very different and difficult-to-compare results of Life Cycle Assessments for individual products, which were possible due to the comparatively open ISO standard. The EU Commission, on the other hand, is striving for an improved use for planning and legislation according to the principle of "comparability before flexibility" and with the creation of product group-specific rules (Product Environmental Footprint Category Rules – PEFCRs). For example, the most relevant life cycle phases, processes and environmental impacts should be identified for each product group. The results of the impact assessment are then aggregated on the basis of a uniform model across all product groups.

After a long pilot phase (2013 - 2018), the experiences and further development requirements were summarised in a working document (Zampori and Pant 2019). In addition to a variety of methodological and process-led discussions, the passages on evaluation were particularly relevant. For the selected 16 impact categories, impact assessments as well as weightings between the impact categories and aggregation to a single score were specified. The assessment process is described in detail in Sala et al. 2018.

In the **PEF aggregation model**, the Life Cycle Inventory data are assessed using a set of predefined impact assessment methods (Sala et al. 2018, p. 9f.). The subsequent standardisation is carried out in relation to global per capita values. The actual weighting of different environmental impact categories is carried out on the basis of a combined model in which expert assessments and the societal perception of the respective environmental problem were considered in summary. In addition, the robustness of the estimation of environmental impacts (data quality and uncertainty) is also included in the evaluation (see in detail). The results of the individual impact categories are multiplied by the corresponding weighting factors and then added together without further weighting in a ratio of 1:1. Based on the prioritisation set by society and science, the PEF aggregation model maps society's assessment of the relevance of various environmental problems. The greater the (numerical) aggregate value, the greater the environmental impact.

Due to the existing weaknesses in data quality and uncertainty in weighting, the European Commission's Joint Research Centre currently recommends not yet including the toxicity-related impact categories in the PEF calculation (Tab. 2).

Table 2 – Recommended PEF assessment model (excluding toxicity-related impact categories)

	Aggregated weighting set	**Robustness factors**	**Intermediate Coefficients**	**Final weighting factors (incl. robustness)**
	(A)	(B)	C=A*B	C scaled to 100
Climate change	15,75	0,87	13,65	**22,19**
Ozone depletion	6,92	0,6	4,15	**6,75**
Particulate matter	6,77	0,87	5,87	**9,54**
Ionizing radiation, HH	7,07	0,47	3,3	**5,37**
Photochemical ozone formation, HH	5,88	0,53	3,14	**5,1**
Acidification	6,13	0,67	4,08	**6,64**
Eutrophication, terrestrial	3,61	0,67	2,4	**3,91**
Eutrophication, freshwater	3,88	0,47	1,81	**2,95**
Eutrophication, marine	3,59	0,53	1,92	**3,12**
Land use	11,1	0,47	5,18	**8,42**
Water use	11,89	0,47	5,55	**9,03**
Resource use, mineral and metals	8,28	0,6	4,97	**8,08**
Resource use, fossils	9,14	0,6	5,48	**8,92**

Source: Sala et al. 2018, p. 34

4 Life Cycle Costing (LCC)

Life Cycle Costing (LCC) is used to ascertain the relevant costs arising for one or more actors in relation to a product and its alternatives in the course of a product life cycle. There is no generally applicable standard yet for the preparation of a life cycle cost analysis, only the DIN EN draft 60300-3-3: 2014-09 and rules on individual applications, for example the technical rule DIN SPEC 77234:2013-09: Guidelines for the assessment of life cycle costs in product-service systems.

Economic analyses are generally considered to be highly exact and objective, but in practice there are considerable problems due to the poor availability of data and different assumptions regarding the types of costs (full costs, partial costs, budget costs, actual costs, time-dependent dynamic costs, scaling-dependent costs), prices influenced by the state (subsidies, prescribed recycling quotas etc.), the assumption of varying interest rates or types of depreciation etc.

Like a Life Cycle Assessment (LCA), an LCC can be divided up into four parts:

- study goal and scope definition,
- inventory analysis (collecting data on individual costs),
- cost assessment,
- interpretation.

Since the costs vary depending on the actor, it is necessary to determine at the start the actor/s for whom the life-cycle costs are being ascertained. While economic data have the advantage that there is a corresponding economic unit (leaving aside the issue of different currencies), it is important to remember nonetheless during the interpretation stage that costs cannot always simply be added up. It makes little sense, for example, simply to count up the wages in countries of the global south and the global north without taking the cost of living in each case into account.

If a comparison with competitor products is conducted and published, the Life Cycle Costing should be accompanied by a critical review.

Decisions and modellings that, based on experience, should be given particular attention are summarized in the checklist presented below (Figure 4).

Figure 4 – Checklist for Life Cycle Costing

Points to be given particular attention in the Life Cycle Costing

- ☑ Determining the actor from whose perspective costs are being ascertained
- ☑ Definition of goal and scope of the study, and of the functional unit
- ☑ Prospective or retrospective
- ☑ Full costs and/or partial costs
- ☑ Actual costs and/or budget costs
- ☑ Dynamic and/or static procedures
- ☑ Prices and/or costs
- ☑ Inclusion of external or informal costs
- ☑ Inclusion of hidden costs and possible liability risks
- ☑ Market prices, prices influenced by legal regulations (subsidies etc.)
- ☑ Taxes and contributions
- ☑ Handling of discounting
- ☑ Handling of depreciation (linear, degressive)
- ☑ Handling of different currencies
- ☑ Handling of different costs of living in different countries
- ☑ Normalization
- ☑ Conduct of a Critical Review if LCC is to be made publicly available

Example of life-cycle costs of three cars

In the chapter on Life Cycle Assessments, three cars were compared to each other (the ID.3 electric car with the petrol Golf and the diesel Golf). The comparison showed that the ID.3 had the best performance from a CO_2 point of view. But what about the costs? The calculation below shows that there are many influencing factors and that the period of time over which costs are incurred also affects the result.

The calculation was based on a cost comparison by ADAC (ADAC 2020) and supplemented by the CO_2 price of petrol and diesel applicable for the period 2021 - 2024. Furthermore, the fuel prices were modified and the prices at the time of the preparation of the present LCA (September 2020) were used as a basis. As far as transferable, the same assumptions were made for the comparison as for the LCA comparison (see p. 8), relating, for example, to the size of the battery. As with the ADAC calculation, the five years 2020 - 2024 were taken as the relevant time period, i.e. not a period of 12 years as in the LCA. The reason for this is that there is still no experience of the residual value of electric cars or the ID.3 for this longer period. The depreciation in the first five years was assumed by ADAC to be comparable to that of diesel and petrol cars; however, the government purchase premium was taken into account. Furthermore, electric cars were also exempt from vehicle tax.

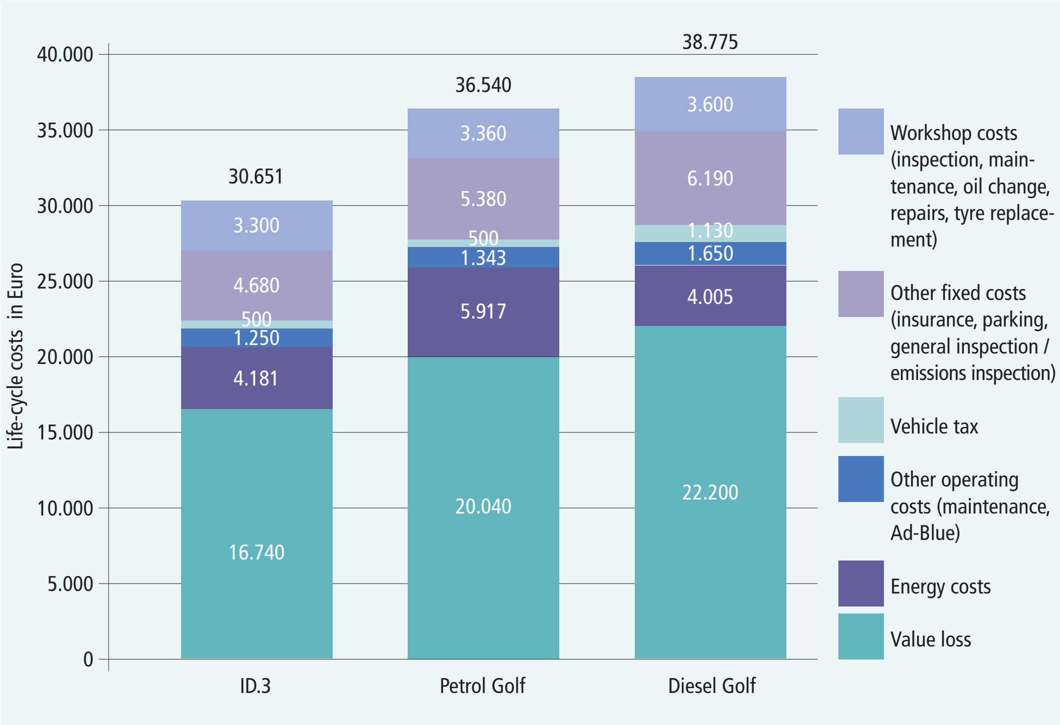
The new prices of the three cars are € 29,687 (petrol Golf), € 32,207 (diesel Golf) and € 35,575 (ID.3). However, in 2020 there was a government subsidy for electric cars of € 6,000, combined with a rebate by the manufacturers of € 3,000 plus VAT, so that the total subsidy amounted to € 9,570 and the reduced purchase price of the ID.3 was only € 26,005.

The additional costs due to CO_2 pricing were calculated as an average over the five years of € 0.076 per litre of petrol and € 0.085 per litre of diesel (CO_2 pricing started in 2021 with € 25 per tonne of CO_2 and is increased in steps up to € 45 in 2024; VAT is added to the average CO_2 price). For the ID.3, it was assumed that 85 % of it is charged at home and 15 % is fast-charged at external charging stations (with double the price of 63 cents/kWh). For home charging, the costs of a newly installed wallbox were assumed (at a cost of € 1,000; service life 10 years, calculated pro rata for 5 years).

For financing the relatively high purchase price of the three cars, no borrowing or interest was assumed by ADAC.

The calculation of the life-cycle costs over the five-year holding period is shown in Fig. 5. The ID.3 is therefore also the most favourable from a financial point of view.

Figure 5 – Life Cycle Costing (Holding period: 5 years, 75,000 km mileage)



Source: Own calculations according to Agora and ifeu

Beyond the cost comparison of the three cars, further interesting conclusions can be drawn from Life Cycle Costing. The average price per kilometre is very high for all three cars, with the ID.3 being the cheapest (41 cents per kilometre), while the costs of the petrol Golf (49 cents/km) and the diesel Golf (52 cents/km) are significantly higher. The real costs of "owning" cars are usually significantly underestimated by consumers. A combination of rail travel and car sharing would be significantly cheaper. Mostly, consumers only look at fuel costs (which are clearly displayed at the fuel pump) and complain about possible price increases for petrol or diesel. However, fuel costs make up only a small part of the average costs: only 10 % for the diesel Golf and only 16 % for the petrol Golf; the electricity costs of the ID.3 are 14 %.

The cost breakdown also shows why a switch from driving to public transport is so difficult. If you own and run a car, the purchase and fixed costs are already over 70 %, while the variable costs per km are comparatively low.

5 Eco-Efficiency Analysis

Eco-Efficiency Analysis is a tool for comparative assessments of environmental and economic aspects in PROSA – and indeed in general wherever social aspects do not play a major role or data on such aspects are difficult to collect.

The term "eco-efficiency" is used in different ways, for example for the eco-efficiency of national economies, of individual companies (e.g. in eco-rating schemes) or of products and services as in PROSA.

Efficiency generally describes the ratio between target (value) and input and must not be confused with **effectiveness**, which characterizes the outcome (regardless of input). In both process management and politics, efficiency and effectiveness are generally aimed at in parallel – a defined goal is to be attained fully or to the greatest possible extent (effectiveness) with the lowest possible input (efficiency).

Eco-efficiency analyses capture the relationship between goal attainment (lowest possible environmental impact) and resource input (costs). Usually only partial aspects are considered, e.g. in the form of energy efficiency analyses, material efficiency analyses, CO_2 efficiency analyses etc. Comprehensive eco-efficiency analyses are methodologically much more demanding, because here a numerical aggregation of the various environmental impacts must be carried out in advance. When comparing several alternatives and considering numerous environmental impact indicators, however, this quickly becomes unmanageable and stands in the way of an integrated, comprehensive assessment. For PROSAplus, an aggregation is therefore recommended, based on the EU's PEF aggregation (see p. 13).

The comparison of two alternatives places the reduction in environmental impact in relation to the additional costs or savings (expressed in monetary units). The larger this value, the more eco-efficient the alternative is. The findings of the LCA and Life Cycle Costing substudies should be presented in both numerical and graphic form for the individual alternatives.

Eco-Efficiency Analysis in PROSA
Product Eco-Efficiency Analysis is an assessment tool within PROSA. It places the findings of an **LCA** and those of Life Cycle Costing in relation to each other. The implementation of the eco-efficiency analysis is based on DIN EN ISO 14045. When performing an Eco-Efficiency Analysis, care must be taken that when setting the goal of the study, the scope of inventory analysis, the functional unit and the allocation rules, etc., similar underlying definitions are applied (cf. also Figure 26 in the annex of this brochure).

Case study CO_2 efficiency of doing laundry

Within the context of the EcoTopTen product initiative, it was examined for the case of the washing machine product group (Rüdenauer and Grießhammer 2004) what contribution further product innovations and, respectively, more efficient user behaviour on the part of consumers when washing (i.e. lower washing temperatures, optimized loading of the machine) can deliver.

The functional unit was defined as "washing the amount of laundry arising in one year in an average private household". The costs were calculated for one private household (purchase costs of the washing machine attributable to one year of use; costs of water, electricity and detergent consumption; costs of wastewater disposal). The following four alternatives were studied:

- **Alternative A**: Low-cost washing machine and average user behaviour
- **Alternative B**: More efficient washing machine (lower water and electricity consumption, automatic load detection) and average user behaviour
- **Alternative C**: Low-cost washing machine and optimized user behaviour (optimized loading and lower washing temperatures than the average)

- **Alternative D**: More efficient washing machine and optimized user behaviour

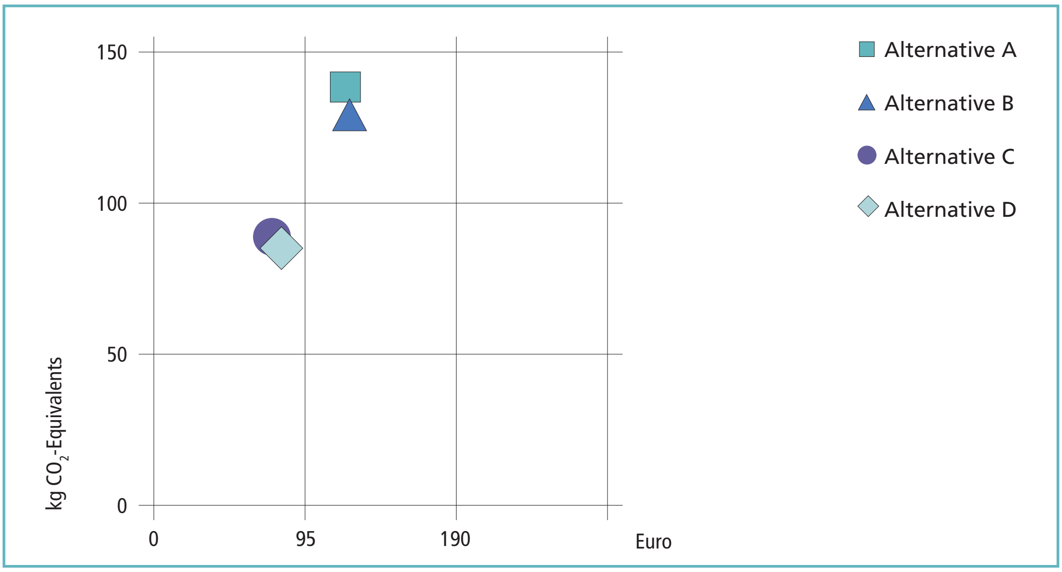
Table 3 and Figure 6 show the findings. In addition, in order to aid comparison, the findings were normalized – i.e. greenhouse gas emissions expressed as a proportion of the greenhouse gas emissions of an average household, and costs expressed as a proportion of the annual consumer spending of an average household. The scale in Figure 6 is set accordingly.

Table 3 – Comparison of washing machines and user behaviour, annual figures

Alternative	GWP	LCC	Savings (GWP)	Extra costs compared to Baseline A	Efficiency
	kg CO_2-equivalents	Euro	kg CO_2-equivalents	Euro	kg CO_2-equivalents/Euro
A (reference)	139	117			
B	130	118	9	1	9
C	84	80	55	-37	-1,49
D	82	84	57	-33	-1,73

GWP = Global Warming Potential
LCC = Life Cycle Costs

Figure 6 – Global warming potential and life-cycle costs of various alternatives



Conclusions for product development
The CO_2 Efficiency Analysis reveals that the behavioural options are substantially more eco-efficient (this is due to the circumstance that it has become usual today to wash inefficiently, using excessive washing temperatures and loading the machine poorly).

The reason for the great importance of appropriate washing behaviour is that little scope now remains to further reduce water and energy consumption through technological refinement of washing machines. It is in the field of detergents that further technical optimization is still possible, for instance by introducing special low-temperature detergents.

6 Social Life Cycle Assessment (SLCA)

Social aspects are of great importance. Traditionally, they have been acknowledged in corporate management by means of consumer research, later also in issue management and in sustainability reporting and, for a few years now, in a narrower sense under "human rights due diligence obligations". The term "social" refers generically to both social and societal aspects. Concerning Social Life Cycle Assessments, three different directions can be distinguished:

- On a more theoretical and academic level, more methodologically oriented work is being under-taken on "Social LCA".
- At the practical level, possible negative social impacts in companies and their supply chains are analysed, especially with regard to human rights due diligence. In most cases, the supply chains of companies are examined with regard to compliance with social standards and, if necessary, certified. Methodologically, the requirements of the Global Reporting Initiative (GRI) are important in this respect.
- Social aspects are of course also recorded in integrated sustainability assessments of products, software tools being increasingly used for this purpose. As a rule, two methods are used to this end – the product-related analysis of the products along the product lines, combined with the company-related analysis of social aspects and, if applicable, other sustainability aspects. The reason for this is usually the large number of supplier companies in the upstream chains, as the example of the notebook manufacturing chain shows (Fig. 7). Against this background, it is hardly possible to record the manufacturing paths of dozens or hundreds of suppliers on a product-specific basis. Instead, potential suppliers' compliance with social standards is analysed and certified if it is met, and primary products are only purchased from certified suppliers.

Within the framework of the UNEP LifeCyle initiative, an attempt was made to integrate the different developments more closely. To this end, method descriptions were presented, and indicators described and categorised (Grießhammer et. al. 2006; UNEP-SETAC-Life Cycle Initiative 2009). At the end of 2020, revised and systematised guidelines were published, supplemented by proposals for the SLCAs of organisations (Benoît et al. 2020).

Lead smelter in Ghane (Source: Öko-Institut)

Compute disassemlby in Ethiopia (Source: Öko-Institut)

Figure 7 – Structure of the notebook PC production chain

Production stages	Products and intermediate products					
6. Marketing	Branded notebook					
5. Final assembly	Notebook					
4. Assembly of complex components	Motherboard and network card	LCD display	Optical drive	Hard disk	Keyboard	Touchpad
	Batterypack	Power supply	Cooling system	Case	Other	
3. Manufacturing of single components	Microchips	Passive electronic components	Printed circuit boards	Cables	Operator controls	Plug connections
	Screw connections	Battery-cells				
2. Refining of raw materials	Silicon wafers	Glass products	Raw plastic products	Copper products	Copper-zinc products	Aluminium products
	...	Palladium products	Tantalum products			
1. Resource extraction	Quartz sand	Crude oil	Copper ore	Zinc ore	Bauxite	...
	Palladium ore	Tantalum ore	...	Scrap metal		

6.1 Social Indicators

Due to the sheer number of potential social aspects for analysis, the definitive task of selecting the aspects and indicators to be studied in depth is of pivotal importance. The key social aspects generally originate in four areas: repercussions on workers (e.g. wages below the minimum subsistence income, or child labour); repercussions on the regional or nearby living population (e.g. through destruction of the habitat of an indigenous population), repercussions of the product on the user (e.g. privacy violation), and indirect repercussions on society (e.g. corruption). In contrast to LCA, as yet and for the foreseeable future, there is no universally accepted list of social indicators. In the context of the first method description of PROSA (Grießhammer et al. 2007), Oeko-Institut provided an extensive list of social indicators, arranged according to four stakeholder groups (cf. Figure 27). The list was extracted in a multi-stage process from several dozen lists of indicators running to over 3,000 proposed social indicators.

In any event, it includes the indicators contained in the most important laws or codes on the theme (ILO-standards, SA 8000, Stiftung Warentest core criteria, etc.). The indicators proposed by PROSA can be augmented and/or replaced to meet context- and product-specific needs. It is recommended that the number of indicators to be studied should be kept within reasonable limits. A 2017 overview of indicators typically used in research and practice (Kuehnen and 2017) showed that the indicators selected until then were predominantly from the field of labour rights and health.

In the new SLCA Guidelines (Benoît et al. 2020), a fifth stakeholder category was introduced in the form of value chain actors – the main reason for this was that the mostly smaller upstream suppliers can have significantly different interests than the mostly dominant companies at the end of the supply chain. Typical impact categories were assigned to each of the five stakeholder groups (see Table 4).

Table 4 – List of stakeholder categories and impact subcategories

Stakeholder categories	Worker	Local community	Value Chain Actors (not including consumers)	Consumer	Society	Children
Subcategories	1. Freedom of association and collective bargaining 2. Child labor 3. Fair salary 4. Working hours 5. Forced labor 6. Equal opportunities /discrimination 7. Health and safety 8. Social benefits / social security 9. Employment relationship 10. Sexual harassment 11. Smallholders including farmers	1. Access to material resources 2. Access to immaterial resources 3. Delocalization and migration 4. Cultural heritage 5. Safe and healthy living conditions 6. Respect of indigenous rights 7. Community engagement 8. Local employment 9. Secure living conditions	1. Fair competition 2. Promoting social responsibility 3. Supplier relationships 4. Respect of intellectual property rights 5. Wealth distribution	1. Health and safety 2. Feedback mechanism 3. Consumer privacy 4. Transparency 5. End-of-life responsibility	1. Public commitments to sustainability issues 2. Contribution to economic development 3. Prevention and mitigation of armed conflicts 4. Technology development 5. Corruption 6. Ethical treatments of animals 7. Poverty alleviation	1. Education provided in the local community 2. Health issues for children as consumers 3. Children concerns regarding marketing practices

Source: Benoît et al. 2020, p. 17

It was shown that the typical impact categories fit the 17 goals of the 2030 Agenda (Benoît et al. 2020, p. 24), but no allocation to the 169 individual indicators of the 2030 Agenda was made.

The authors distinguish between two different approaches – the "Reference Scale Approach" and the "Impact Pathway Approach" – the latter being methodologically equivalent to LCA.

Special features of the SLCA
Compared to LCA, there are some special features of Social Life Cycle Assessment that can be handled well if they are taken into account at an early stage:

- Social aspects can be highly diverse and weighted in highly disparate ways by different stakeholder groups in different countries and regions. Social evaluations also change much more quickly over time than environmental evaluations, for example.
- Major importance therefore attaches to the pre-selection of the social aspects to be considered in depth. Pre-selection is thus a part of the normative evaluation.
- So far, the availability of data has been poor. Normally, neither quantitative nor qualitative data alone will provide sufficient information; both kinds are needed.
- The SLCA also includes potential positive impacts. According to the Life Cycle Initiative, these can be divided into three types (Benoît et al. 2020, p. 29 ff.):

1. Type A – Positive social performance going beyond business as usual;
2. Type B – Positive social impact through presence (product or company existence);
3. Type C – Positive social impact through product utility.

6.2 The PROSA SLCA

SLCA is one of the core tools used within PROSA. In the course of implementation, care must be taken to coordinate the key parameters with LCA and Life Cycle Costing (cf. Integration Checklist in the Annex). It is possible, however, to carry out SLCA as a free-standing analysis or in combination with (either) LCA or Life Cycle Costing. The procedure is briefly described below. The SLCA guidelines can be referred to in detail (UNEP 2020).

Social aspects are investigated throughout the product line normally in comparison to some alternative. Stakeholders should be involved as far as possible (cf. Figure 24 in the annex). The methodological procedure corresponds to that for the Life Cycle Assessment (LCA) and is carried out in four steps.

(1) Goal and scope definition
Defining the goal of the study, system boundaries, reference alternatives/scenarios, etc. Three points require particular attention:

- The geographical system boundaries are normally defined so as to include countries with different social conditions and cultures.
- Product utility, and hence the functional unit, must be described with considerably more precision than is usual in the LCA (cf. also Benefit Analysis). For example, there should be a description of what are known as "symbolic" utility aspects (prestige,etc).
- The selection of indicators makes special demands (see below), but surprisingly there tends to be rapid agreement on the selection of the most important indicators, even where stakeholder positions are otherwise highly divergent.

(2) Life Cycle Inventory (LCI)
Due to the poor availability of data so far, this area poses a particular challenge. Only a small proportion of quantitative data is available from statistical or comparable sources. As yet there are no module data for central processes or intermediate products (e.g. cotton manufacturing, plastics manufacturing, transport). The upstream chains are often complex and involve suppliers from many countries. Whilst small material inputs can often be disregarded for LCA purposes, when it comes to the analysis of social conditions, small companies in the upstream chain can be highly relevant.

The depth of analysis can be varied depending on the question being addressed (qualitative assessment, expert judgement, if-then assumptions, semi-quantitative or quantitative data collection).

(3) Impact Assessment
As in LCA, the key elements are: analysis of data quality; classification; characterization; and, optionally, normalization. Qualitative data can be "translated" into a quantitative form by applying specified methods.

- Example of classification in the employment field: categorization into full-time and part-time jobs, mini-jobs, state-subsidized self-employment, pseudo self-employment, etc.
- Example of characterization in the employment field: weighting of the specified types of employment and calculation of totals (e.g. full-time job at 100 %, part-time job at 50 %, etc.)
- Example of normalization: relating the employment figure to the numbers of people in employment in the country studied

(4) Interpretation of results
As in the case of LCA, the key elements are checking for completeness, signifi-

cance and consistency with the goal of the study, and carrying out sensitivity analyses.

Ideally the interpretation should be carried out in collaboration with stakeholders and will normally be qualitative-discursive. Nevertheless, there are a range of situations which require the use of (semi-) quantitative interpretation frameworks, e.g. portfolio screening as an internal company exercise, product testing involving the comparison of multiple products, or the integration of many individual results into an overall evaluation of sustainability. This is also emphasised in the guidelines of the Life Cycle Initiative (Benoît at al.", p. 83). This proposes two different systems: a five-part numerical rating (-2, -1, 0, +1, +2) or a colour-graded rating, a kind of traffic light system, but in four gradations (very high risk, high risk, medium risk, low risk). Further weightings and an overall aggregation are possible. Ideally the overall interpretation should be carried out in collaboration with stakeholders. More important than the numerical aggregation is the derivation of options for action to avoid or reduce negative impacts.

7 Benefit Analysis

The benefit analysis is used to analyse and evaluate the utility of products and services. Benefit analysis can be used in the context of product and sustainability policy (implementation of the 2030 Agenda and the SDGs), by companies, in public procurement, by large organisations such as churches, in the awarding of labels, and by testing and consumer organisations.

Whereas benefit or utility is recorded and defined slightly above the functional unit or the functional equivalent in the case of a Life-Cycle Assessment, in PROSA benefit/utility is analysed more intensively. Beyond the core benefit of a product or service defined in the functional unit, additional benefit aspects are considered. Relevant material and energy flows as well as economic and social aspects that can have a positive or negative impact on sustainability are taken into account. This extension can prove useful for many objects of investigation, since utility aspects ultimately determine consumers' purchase and use decisions; furthermore, if higher social or ecological risks are involved, the assessment has to be reasoned and answered for in terms of product policy in view of relevant legislation – such as in the Socio-Economic Benefit Analysis (SEA) in REACH, the EU's Chemicals Act.

The benefit analysis is used to analyse – depending on the issue and with the help of consumer research – practical utility, symbolic utility and societal utility. The results will be quite different and will be assessed differently in different countries and target groups. This should be taken into account when defining the scope of the study in the analysis and evaluation.

Figure 8 – Utility types and usefullness of results

Utility type	The users of the benefit analysis and their reasons
Practical utility	Portfolio strategy, opportunities analysis; optimization of product development and marketing
	Testing and consumer organizations: basis for purchase recommendations
	Users: basis for purchase and use behaviour
	Product policy: basis for risk-benefit assessment in relation to laws (e.g. Ecodesign Directive) and support programmes
Symbolic utility	Companies: optimization of product marketing, first and foremost for sustainable products
Societal utility ("public value")	Companies: product development, product improvement, creating transparency throughout the supply chain, portfolio strategy, opportunities analysis; optimization of („public value") product marketing
	Users: Ethical basis for purchase, identification of benefit/utility aspects beyond core benefit
	Product policy: implementation of the 2030 Agenda and the use-related SDGs, basis for risk-benefit assessment in relation to options for action, laws and support programmes, basis for political assessments with regard to compliance with planetary boundaries and potential sufficiency measures

There are various concepts and descriptions of **practical utility**: functional utility, technical utility, main utility, (simply) utility, core performance, quality (cf. Fig. 9). One example of practical utility is the result achieved after washing laundry in terms of hygiene and visual aesthetics. The essential elements of practical utility are measurable (performance, durability, etc.) and can be recorded in comparative product tests, quality assurance systems or ISO standards. At the same time, individual elements of practical utility may turn out differently for individual users (gain in time, for example).

Figure 9 Practical Utility Checklist

- ☑ Suitability for use (according to existing test criteria, e.g. from Stiftung Warentest)
- ☑ User-friendliness (according to DIN EN ISO 13407)
- ☑ Availability
- ☑ Convenience / time saving
- ☑ Durability
- ☑ Functional reliability
- ☑ Safety / security in use
- ☑ Good consumper information
- ☑ Good consumer service
- ☑ Reparability / availability of spare parts (according to Ecodesign Directive)

Very often there are sub-criteria for the utility aspects mentioned. For example, the practical utility of a media centre is determined, among other things, by the loading speed, the time it takes to establish a connection and the sound and picture quality. It is clear from this that weightings are necessary in this context depending on the product or service; usually they are implicit.

The practical utility checklist can serve as a grid to derive utility aspects in different sectors, product groups and services.

For cars, for example, several dozen practical utility aspects are listed in the ADAC car database, and further aspects (such as reliability or safety) are examined in tests. Typical central aspects, which can vary greatly depending on the model and which are particularly examined or presented in advertising or tests, are performance (in horsepower), top speed, acceleration (from 0 to 100 km/h), consumption figures and CO_2 values, number of seats and boot volume. Many other aspects are complied with by most new cars, such as folding rear seats, electric windows, automatic start-stop or parking aids. With the introduction of electric cars, new aspects of use have been added, such as the range with one battery charge (in the case of the VW ID.3 electric car with a battery of 58 kWh it is 426 km, for example) or the charging time. In this respect, at least at the current state of the art, there are clear disadvantages compared to combustion engines. Electric cars generally have advantages in terms of driving noise at low speeds and in terms of performance or acceleration. The ID.3, for example, has an output of 204 hp, while comparable diesel and petrol Golfs have 150 hp. Conversely, electric cars are designed with lower top speeds (because high speeds considerably shorten the range). Thus, while the top speed of the ID.3 is still very high at 160 km/h, it is much higher for the diesel and petrol Golfs at 224 or 223 km/h respectively. For everyday usability, however, the high acceleration values and top speeds are likely to have little relevance.

Product policy decisions typically take into account the practical utility of products. Examples are the derogation for asthma sprays in the CFC-Halon Prohibition Ordinance, derogations in the EU regulations on chemicals or the consideration of higher practical utility (e.g. cooling volume of refrigerators or drum sizes of washing machines and tumble dryers in the energy efficiency labelling of electrical appliances). The analysis of utility can also show that some product policy decisions are questionable: In the case of the car label, the efficiency classes are structured according to weight. A heavy car with high consumption can therefore get a better label than a small car with lower consumption but higher consumption in the small car class. The majority of consumers therefore misunderstand the label (Muster et al. 2020, p. 133).

Symbolic utility is also known as psychological utility or additional utility. It is conveyed via the product and its marketing and triggers feelings or moods such as prestige, a new sense of identity or the sense of belonging to a group. One example would be the metallic paint on a car.

The differences between practical utility and symbolic utility are not all hard and fast and can be variously interpreted and experienced depending on the person concerned. One used to be able to assume that practical utility was the same as the main utility for the consumer and that symbolic utility was merely additional utility. In prosperous societies and mature markets with high product quality, the perception of utility may shift in the case of some product groups, so that practical utility is taken for granted and is perceived as being a basic quality, with symbolic utility dominating people's perceptions (in the case of certain textiles, for example, more money is spent for the "brand" than for actual product quality).

Figure 10 – Symbolic utility checklist

- ☑ External appearance / design / taste / feel / sound etc
- ☑ Prestige / status
- ☑ Identitiy / autonomy / development
- ☑ Expertise
- ☑ Safety / precaution / care for others
- ☑ Privacy
- ☑ Social contact / fostering community
- ☑ Enjoyment / pleasure / joy / experience
- ☑ Compensation / reward
- ☑ Consonance with societal, religious or ethical meta-preferences

7.1 Societal utility („Public Value")

Within a social market economy, it is assumed that consumers make decisions about the utility of products and hence generate demand for particular products and services. And that is a good thing. But the state should intervene when the ecological or societal burdens of products are too high for the common good. It is also expected that the state will promote promising technologies and products for the future to ensure the sustainable development of society. Appropriate support programmes, tax relief and laws should only come into being, however, on the basis of clear analysis and reasoned assessment. In line with a risk-benefit assessment both the risks and the benefit need to be clearly analysed and assessed. Indeed, this is increasingly becoming standard in EU legislation.

PROSA is aimed above all at products that have a high societal benefit and offer companies "sustainability opportunities". The products should make an essential contribution to key national and international objectives, such as international poverty reduction (set out in the Millennium Development Goals), securing peace, the basic objective of the Rio Declaration (economic development and satisfaction of basic needs), climate protection (Framework Convention On Climate Change), the preservation of biodiversity (Convention on Biological Diversity), as well as jobs and societal stability. A minimum precondition in this can be that the products have a high practical utility and no contrary impacts within society.

The assessment of societal benefit depends crucially on the status of the society. For example, the satisfaction of the basic need for food is assumed to be taken for granted in a rich country.

On the basis of direct reference to the 2030 Agenda with its 17 Sustainable Development Goals (SDGs) which cover a broad spectrum of societal goals with regard to societal needs, the analysis of societal benefits can be universally justified and concretised. Benefit indicators can be derived directly from the 169 SDG sub-goals of the 2030 Agenda. SDG sub-goals that are relevant for societal benefit must fulfil the following criteria:

- The SDG sub-goal must be influenceable at the product or service level.
- The influence of the product / service on the SDG sub-goal must be direct (i.e. indirect effects must not be taken into account).
- The benefit effect unfolds beyond the core benefit of the product or service; relevant material and energy flows as well as economic and social aspects are taken into account.

In this way, a total of 30 benefit indicators can be specified on the basis of the SDG alignment, cf. Table 5. Particularly relevant SDGs, each with several benefit indicators, are SDG 2 (Zero Hunger), SDG 3 (Good Health and Well-Being), SDG 6 (Clean Water and Sanitation), SDG 8 (Decent Work and Economic Growth) and SDG 12 (Sustainable Consumption and Production).

Due to the binding nature of the 2030 Agenda, it is obligatory to consider all indicators when carrying out the benefit analysis for products or services. In order to be able to claim a benefit aspect, corresponding evidence must be provided in each case (e.g. scientific peer-reviewed study). As a minimum requirement, it must also be ensured that the products have a high utility value and no counteracting or harmful effects on different user groups (such as cigarettes or smoking).

The following example shows which possibilities the 2030 Agenda offers for the benefit analysis:

SDG 3.4: „By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment, and promote mental health and well-being".

This SDG provides the starting point for the benefit indicator B4 "Reducing mortality", specifically the reduction of premature mortality from cardiovascular diseases, cancer, diabetes or chronic respiratory diseases, which is considered relevant especially for the medical, pharmaceutical and food sectors. In addition to the existing sustainability indicators (cf. chapter 8), this indicator can be used, for example, to map important additional benefit aspects beyond the core benefit in the case of food, e.g. health-promoting effects of olive oils with a particularly high content of polyphenols (antioxidants) in accordance with the „Nutrition and Health Claims" codified at EU level. The evidence for such a benefit aspect would have to be provided by a scientific study conducted according to the principles of Good Clinical Practice (GCP) and subjected to a critical review by a third independent party.

Table 5 – Indicators for Societal Benefit

#	SDG	Indicator
B1	2.1, 2.2	Reduction of hunger and malnutrition (by access to safe, nutrious and sufficient food; addressing nutrition needs of adolescent girls, pregnant and lactating women, children and older persons)
B2	2.3	Increasing incomes of small-scale food producers
B3	2.4, 2.5	Strengthening sustainable food production systems (maintaining ecosystems / genetic diversity, fostering resilience against climate change, extreme weather, drought, flooding and other disasters)
B4	3.1, 3.2, 3.3, 3.4	Reducing mortality (from maternal mortality / neonatal mortality / epidemics of serious diseases / cardiovascular diseases / cancer / diabetes / chronic respiratory diseases)
B5	3.5	Strengthening the prevention and treatment of substance abuse
B6	3.6	Reducing deaths / injuries from road traffic accidents
B7	3.9	Reducing deaths / injuries from hazardous chemicals and air, water and soil pollution and contamination
B8	4.4, 4.7	Strengthening knowledge and skills related to sustainability issues (ICT skills / sustainable development in general)
B9	6.1, 6.2	Improving the access to safe drinking water, sanitation and hygiene
B10	6.3	Improving water quality by reducing the release of hazardous chemicals and materials
B11	6.4	Increasing water-use efficiency and strengthening sustainable supply of freshwater
B12	7.2	Enabling / increasing the production of renewable energy
B13	7.3	Enabling / increasing energy efficiency
B14	8.5, 8.6	Creation of well-paid jobs / reducing youth unemployment
B15	8.8	Strengthening secure working conditions
B16	8.9	Strengthening sustainable tourism (local job creation, promotion of local culture and products)
B17	8.10	Expanding the access to banking, insurance and financial services
B18	9.4	Fostering decarbonisation and resource efficiency of industries
B19	11.5	Reducing deaths / people affected by disasters
B20	11.6	Improving urban air quality (with special attention to particulate matter)
B21	12.2	Strengthening sustainable management and efficient use of natural resources (by reducing the material footprint of products and services)
B22	12.3	Reducing food losses and food waste
B23	12.4	Reducing the release of chemicals / hazardous waste into air, water and soil
B24	12.5	Reducing waste generation through waste prevention, recyclability and reusability
B25	13.2	Significant contribution to GHG emission reductions
B26	14.1	Reducing marine pollution / marine littering
B27	14.7	Strengthening the sustainable use of marine resources (fisheries, aquaculture and tourism)
B28	15.1	Fostering the conservation and sustainable use of ecosystems / biodiversity
B29	16.10	Strengthen public access to information
B30	1.3, 3.8, 4.3, 6.1, 7.1, 9.1, 9.3, 11.1, 11.2,	Strengthening the availability of affordable and sustainable products / services (overarching indicator for the aspect ‚affordable')

A detailed description of the individual indicators in the form of „indicator profiles" can be found at www.prosa.org.

7.2 Consumer Research in PROSA

There are two different research traditions and areas for practical application in consumer research: marketing-oriented consumer research and consumer-oriented consumer research. The underlying methods are the same, but the questions and analytical perspective are different.

Marketing-oriented consumer research is carried out predominantly on behalf of companies; its primary objective is to ensure that products sell successfully ("**sales research**"), although of course potential problems in the post-sale phase are also taken into account (dissonance reduction management and customer satisfaction research). By contrast consumer-oriented consumer research ("**consumption research**") analyses from the point of view of consumers and society and also undertakes in-depth analysis of the post-sale phase – in particular the use phase, use patterns and possibilities for an environmentally sound, cost-saving and socially sustainable use of products. Both points of view should be given attention in a sustainability-oriented study.

The familiar quantitative and qualitative consumer research tools can be used for the benefit analysis in PROSA (questionnaires, interviews, empirical content analysis, observations, experiments and test situations); qualitative social research methods such as group research are generally given greater emphasis, however. Focus groups are especially well suited for this because complex aspects of sustainability and difficult social-psychological issues can be analysed here with limited effort. Being together in a group has the advantage that the generation of processes of opinion formation can be speeded up in the group, observed and analysed later according to specific target groups. In addition to the traditional questions (practical utility, symbolic utility, target groups) patterns of use, habits of use and aspects of sustainability are also subjected to particular study.

In focus groups with PROSA, an expert is included in each group in order to answer tricky questions in an ad hoc manner in the overlapping areas of technology, ecology and use (cf. Grießhammer et al. 2007, p. 37ff). In addition to the focus groups it can also be useful to consult stakeholders and experts in mini-groups.

The results of consumer research or benefit analysis are closely coordinated with those from the Life-Cycle Assessment (LCA), the Social LCA and the Life-Cycle Costing.

The aim of the benefit analysis is not to produce an absolute assessment of products but rather to ascertain opportunities and products suited for the future and to derive potential ways of optimizing products so that they become more sustainable. For example, car sharing can be made more attractive when the symbolic utility aspects of individual cars are made clearer and this symbolic utility can be satisfied by car sharing as well.

8 Sustainability criteria on the basis of the 2030 Agenda

When analysing and evaluating the impact of products along their life cycle, the selection of the impact categories and indicators to be considered plays a central role for the result. While LCAs incorporate a variety of impact categories that are taken into account accordingly (see page 8), analyses are often restricted to greenhouse gas assessments in practice. According to the EU PEF Strategy, the relevant impact categories for individual product groups should be determined in advance (see p. 12).

Standards that can be used for analysing the economic dimension of sustainability are, for example, DIN EN ISO 14045 on eco-efficiency, or the draft standard DIN EN 60300-3-3:2005-03 on **Life Cycle Costing**. Here, costs (expressed in euros or other currencies) are the central and usually the only indicator. However, they should routinely be supplemented by the analysis of external costs (see p. 14 ff).

Other economic aspects are reported in practice using the Social LCA. According to the SLCA guidelines, 40 impact categories should be taken into account, and the number of potential individual indicators is far greater. Against this background, it is obvious that a narrowing down to aspects to be analysed with priority must take place (see p. 19 ff).

This applies in particular to **integrated product sustainability analyses**. The prioritisation – as in the case of SLCAs – has so far often been carried out by a stakeholder panel, as in the case of the product assessment tool for IT and telecommunication products of the GeSi – Global e-Sustainability Initiative. The comparatively open or specific selection of indicators has long been justified by the fact that there is no generally accepted normative or legally defined background for this.

With the adoption of the **United Nations' Agenda 2030** in September 2015, this has fundamentally changed (United Nations 2015). The 2030 Agenda contains 17 overarching Sustainable Development Goals (SDGs) and 169 sub-goals. The ratifying countries have thus also committed them-selves to implementing the SDGs in their national strategies. However, municipalities, companies and consumers should also implement the goals of the 2030 Agenda as far as this is possible within their sphere of influence.

The 2030 Agenda thus provides a globally accepted system of indicators for measuring the SDGs. However, only a few dozen of the 169 sub-goals explicitly refer to products and companies; others, such as the indicator "Ensure access for all to adequate, safe and affordable housing" (SDG 11.1), cannot be realised directly by individual companies.

Product- and company-relevant indicators of the 2030 Agenda

In the "SDG Assessment" research project (Eberle et al. 2021) funded by the German Federal Ministry on Education and Research (BMBF), a method called "SDG Evaluation of Products" (SEP) was developed (www.sdg-evaluation.com) which provided for a reasoned restriction to those indicators to the achievement of which products, services and companies can actually contribute (Eberle and Wenzig 2020).

Indicators for measuring the SDGs have already been developed in the General Indicator Framework (GIF) of the United Nations for the 2030 Agenda. These are the authoritative source of the selected indicators. In cases where the indicators could not be applied, they were amended or supplemented by more suitable indicators. The supplemented indicators usually originate from other accepted indicator frameworks, such as those proposed in the European process to establish a Product Environmental Footprint (European Commission 2012) or proposed by the Global Reporting Initiative (GRI) (GRI 2016a; GRI 2016b). This approach was chosen to ensure that the selected sustainability indicators have the greatest possible connectivity and compatibility with other initiatives, such as the European Product Environmental Footprint process (European Commission 2012).

For the narrowing down, two test questions were asked:

- Does the product or service along the life cycle have a direct impact on the achievement of the SDGs? The resulting 25 indicators are referred to as Case 1 (C1) indicators.
- Do the companies that produce or offer the product or service along the life cycle have a direct influence on the achievement of the goal through their activities, for example through the level of wages paid or through measures to prevent corruption? The resulting 20 indicators are referred to as Case 2 (C2) indicators.

In a second step, the indicators were subdivided into **mandatory core indicators** and **comprehensive indicators**. The following two "filters" were used to determine the core indicators:

- The Planetary Boundaries (Steffen et al. 2015) to select the most relevant ecological indicators,
- the Declaration of Universal Human Rights of the United Nations (United Nations 1949) for selecting the most relevant socio-economic indicators.

Thus, 21 mandatory core indicators could be identified. For individual sectors, indicators going beyond these were defined as mandatory. The C1 indicators are shown in Table 6, the C2 indicators in Tab. 7. A detailed description of the individual indicators can be found in the form of indicator profiles at: www.sdg-evaluation.com.

Table 6 – C1 indicators for the analysis of products (Eberle and Wenzig 2020, p. 28)

Impact Indicators			
#	**SDG**	**Indicator**	**Core**
C1.1	2.4	Soil quality index	
C1.2	2.4, 15.9	Terrestrial biodiversity potential	X
C1.3	2.4	Accumulated Exceedance (terrestrial eutrophication, acidification)	X
C1.4	3.9	Comparative Toxic Unit for humans C1.4a: cancer C1.4b: non-cancer	
C1.5	3.9	Photochemical ozone creation potential	
C1.6	3.9	Disease incidences (Particulate matter)	
C1.7	3.9, 6.3, 12.4	Comparative Toxic Unit for ecosystems	X
C1.8	6.3	P-equivalents (freshwater eutrophication)	X
C1.9	6.4	Scarcity-adjusted water use	
C1.10	8.4, 9.4	Abiotic resource depletion C1.10a: minerals & metals C1.10b: fossil fuels	
C1.11	9.4, 13.2	Global Warming Potential	X
C1.12	12.4	Ionising radiation potential	
C1.13	14.1	N-equivalents (marine eutrophication)	X
C1.14	14.2	Marine biodiversity potential	X
C1.15	14.3	Marine acidification potential	

Inventory Indicatores			
#	**SDG**	**Indicator**	**Core**
C1.16	2.3	Income/ha - only Small Scale Producers	
C1.17	2.3	Yield/ha - only Small Scale Producers	
C1.18	3.6	Death rate due to road traffic injuries	
C1.19	6.4	Water use	
C1.20	7.2, 7.3	Energy use C1.20a: renewable C1.20b: non-renewable	X
C1.21	12.3	Food losses	
C1.22	12.4	Waste generation (per fraction)	
C1.23	12.5	Use of recycled material	
C1.24	14.1	Marine debris (incl. (micro) plastic)	X
C1.25	14.4	Share of by-catch in catches	X

Table 7 – C2 indicators for the analysis of companies

Inventor-Indicators			
#	**SDG**	**Indicator**	**Core**
C2.1	1.1	Workers earning below poverty line of 1.90$/day	X
C2.2	1.3	Coverage of social security support	X
C2.3	2.4, 3.6, 5.1, 6.5, 6.6, 7.3, 8.7, 8.8 9.3, 12.2, 12.3, 12.4, 13.2, 14.2, 15.1-15.6, 15.8, 15.9, 15.a, 15.b, 16.5, 16.a, 17.7, 17.11, 17.16, 17.17	Coverage of product-related sustainability (risk) management: C2.3a: sustainable agriculture (SDG 2.4) C2.3b: driver/passenger safety/reduction of accidents (SDG 3.6) C2.3c: equal opportunities (SDG 5.1) C2.3d: water use & scarcity (SDG 6.5, 6.6) C2.3e: natural resources (SDG 12.2) C2.3f: food losses (SDG 12.3) C2.3g: chemicals (SDG 12.4) C2.3h: waste (SDG 12.5) C2.3i: climate change(SDG 13.2) C2.3j: marine biodiversity (SDG 14.2) C2.3k: terrestrial & freshwater biodiversity (SDG 15.1-15.5, 15.8) C2.3l: patents on natural resources (SDG 15.6) C2.3m: corruption prevention (SDG 16.5) C2.3n: human rights (SDG 16.a) C2.3o: promotion of environmental sound technologies in developing countries (SDG 17.7) C2.3p: energy efficiencyz (SDG 7.3) C2.3q: small scale suppliers/industry borrowers in supply chain (particular from LDC) (SDG 9.3) C2.3r: share of products/materials from DC (SDG 17.11) C2.3s: Investments in conservation and sustainable use of biodiversity/ecosystems (SDG 15.a, 15.b) C2.3t: Engagement in multi-stakeholder partnerships for sustainable development (SDG 17.16, 17.17)	X C2.3c C2.3i C2.3j C2.3k C2.3o C2.3p C2.3s
C2.4	2.5	Number of used breeds / varieties	X
C2.5	3.8	Share of employees covered by health insurance or a public health system	X
C2.6	3.9, 8.8	Number of, time loss or frequency rates of fatal and non-fatal occupational injuries	
C2.7	3.9, 8.8	Access of workers to protective clothing	
C2.8	4.4, 4.7, 13.3, 16.5	Share of employees trained in sustainability issues C2.8a: ICT skills (SDG 4.4) C2.8b: sustainability in general (SDG 4.7) C2.8c: climate change (SDG 13.3) C2.8d: corruption prevention (SDG 16.5)"	
C2.9	4.5	Average hours of training per employee by share of men/woman	
C2.10	5.1, 8.5	Ratio of average hourly wage of men to women	X
C2.11	5.5	Share of women in managerial positions at all hierachy levels	X
C2.12	6.1	Availability of safely managed drinking water at work	X
C2.13	6.2	Availability of lockable sanitation at work, including a hand-washing facility with soap and water	X
C2.14	6.3	Percentage of safely treated wastewater flows	
C2.15	8.6	Share of employees (incl. apprenticeships) under 24	
C2.16	8.7, 8.8	Fulfillment of ILO conventions by sex C2.16a: freedom of assembly C2.16b: child work C2.16c: forced labour C2.16d: discrimination C2.16e: collective bargaining	X
C2.17	9.5	Investments in R&D	
C2.18	10.2	Relative poverty rate (50% of median disposable income)	X
C2.19	10.3	Palma Ratio	
C2.20	12.6, 12.8, 14.4	Sustainability information about the product (incl. value chain) publicly available	

9 Sustainability Assessment and Aggregation

The analysis of the sustainability of products or companies is already complex. The subsequent evaluation of the results of dozens of indicators represents a further challenge.

Before going into detail, three important points should be noted in advance:

- In contrast to the sustainability analysis for products, the evaluation is only poorly developed in terms of methodology.
- The definition of goal and scope with the selected indicators determines the result to a large extent. If an analysis is limited to a Life Cycle Assessment, for example, social aspects are basically not evaluated. Likewise, if relevant indicators from many possible social indicators are not analysed in a social LCA, no results are available for the evaluation.
- Assessments should always be action-oriented. It is debatable whether indicator A or indicator B is more important. It would be preferable to find and implement measures that reduce the negative impacts of A <u>and</u> B.

The LCA according to **ISO 14040** provides for impact assessment and interpretation, but not for evaluation and aggregation. In practice, however, aggregation can be observed, especially when several products or alternatives are to be compared. Such aggregation is also used in the EU's **PEF process** (see p. 12f).

In the case of the **Social Life Cycle Assessment (SLCA)**, a semi-quantitative evaluation of the individual Life Cycle Inventory results is recommended, namely a five-part numerical rating (-2, -1, 0, +1, +2) or a kind of traffic light system, as well as a classification of the positive impacts. Further weightings and an overall aggregation are possible. However, the overall assessment should ideally be determined together with stakeholders (see p. 19ff).

Life Cycle Costing provides a singular indicator result in the form of costs, so that it is easy to distinguish between two alternatives (see p. 14ff). If necessary, it can be supplemented by an **Eco-Efficiency Analysis** (see p. 17f).

In **Sustainability Analyses**, weighting and evaluation with a stakeholder panel has proven successful so far. In the software-supported product evaluation system of GeSi – the Global e-Sustainability Initiative for IT and telecommunication products and services, numerical evaluations of individual indicators as well as the weightings between the indicators towards an overall aggregation were determined in this way.

A threefold requirement is made for the Life Cycle Inventory data related to sustainability indicators:

- Firstly, the results must be standardised, i.e. related to an overarching comparative value, such as wages paid to the minimum standard of living in the respective country.
- Secondly, a useful function must be developed for the evaluation between the Life Cycle Inventory result and the comparative value. Unlike with LCA results, the relationship is not always linear. For example, the target for increasing the proportion of women in management positions is not 100 %, but 50 %. This target value can be considered well met even with a small deviation, e.g. if the share of women is between 45 % and 55 %.
- Thirdly, the corresponding results along the product line must be summarised and weighted for different companies in different countries.

Assessment of individual sustainability indicators

In the **SDG assessment** research project (Eberle et al. 2021), these three requirements were implemented for some company-related indicators, using the method of SDG-Evaluation of Products (SEP) (cf. Eberle and Wenzig 2020). Furthermore, rating curves were derived that show a relationship between the performance of the indicator and the contribution to the respective SDG. In order to assess the potential contributions of the C2 indicators to the achievement of the SDGs, a scale of „-1“ to „+1“ was chosen (“+1” means that the product contributes fully to achieving the sustainability goal; “-1” means that the product has a negative impact on achieving the sustainability goal).

For example, indicator C2.1 “Employees earning below the UN poverty line” measures how many workers along the value chain earn below the extreme poverty line set by the UN of currently $ 1.90 per day. Accordingly, a full contribution to the SDG rated “+1” means that all employees along the entire value chain earn above the poverty line. The percentage of people earning according to the poverty line on average in a specific country was set as 0. Assessments based on the individual enterprises involved are then summarised according to their share of the hours worked to produce the product under investigation.

Table 8: Summary of indicators that concretise target SD6 (Clean water and adequate sanitation) (Eberle and Wenzig 2020, p. 18)

	Agriculture		Processing		Overall assessment
	Location 100%	Product (Share of working hours, 93%)	Location 100%	Product (Share of working hours, 93%)	
C2.3d Water use & scarcity	0,00	0,00	0,33	0,02	0,02
C2.12 Drinking water at the workplace	1,00	0,93	1,00	0,07	1,00
C2.13 Adequate sanitation at work	1,00	0,93	1,00	0,07	1,00
C2.14 Wastewater treatment	1,00	0,93	1,00	0,07	1,00
SDG 6 (balanced aggregation)	0,75	0,70	0,83	0,06	0,76

For further assessment, individual indicators are assigned to the individual SDGs (cf. example in Tab. 8). They can also be aggregated. Even if this is with the same weighting (1:1:1) as in the example, this is still a normative assessment. The general public might give a higher weighting to “water scarcity”, whereas workers might give a higher weighting to “adequate sanitation at the workplace”. For this reason, sustainability analyses should be accompanied by stakeholder panels – starting with the definition of the target, framework conditions and indicators up to the final evaluation and, if necessary, aggregation.

To facilitate the evaluation, the “ProFitS” software was developed (see p. 36ff).

10 ProFitS

For several decades now there has been debate on sustainable development – sustainability strategies and sustainability goals have been defined, sustainability reports were produced, and products rated as sustainable or non-sustainable, as the case may be. Surprisingly, there is little debate and little transparency as to **how in fact sustainability is evaluated and which concrete improvements are proposed and implemented**.

PROSA, in contrast, places a strong focus on a verifiable evaluation process and a clear evaluation framework. PROSA provides for this purpose the software **ProFitS** (Products-fit-to-Sustainability) integrated evaluation framework and software. ProFitS is action-oriented and its outcome can be presented in a qualitative-argumentative manner or in quantitative terms. Where required, it can be complemented or substituted by other transparent evaluation frameworks.

The purpose of the evaluation is generally to prepare strategic decisions and to identify sustainability opportunities and optimization avenues, and NOT to perform any absolute numerical evaluation.

Nonetheless, ProFitS does provide opportunities for quantitative assessment,

- because this makes it possible to treat and present the great array of findings on different variants in a more systematic fashion,
- because, curiously, it is often the quantitative assessment proposed in a strategy team or at a stakeholder workshop that triggers more in-depth discussion of qualitative evaluations,
- because companies with large product portfolios use indexes.

The outcome of ProFitS therefore can be aggregated as one index where required. All original data and all the individual evaluations steps, however, can be traced back. In addition to quantitative assessment, the ProFitS evaluation framework routinely asks which measures can be taken to improve an indicator or state that has been rated poorly.

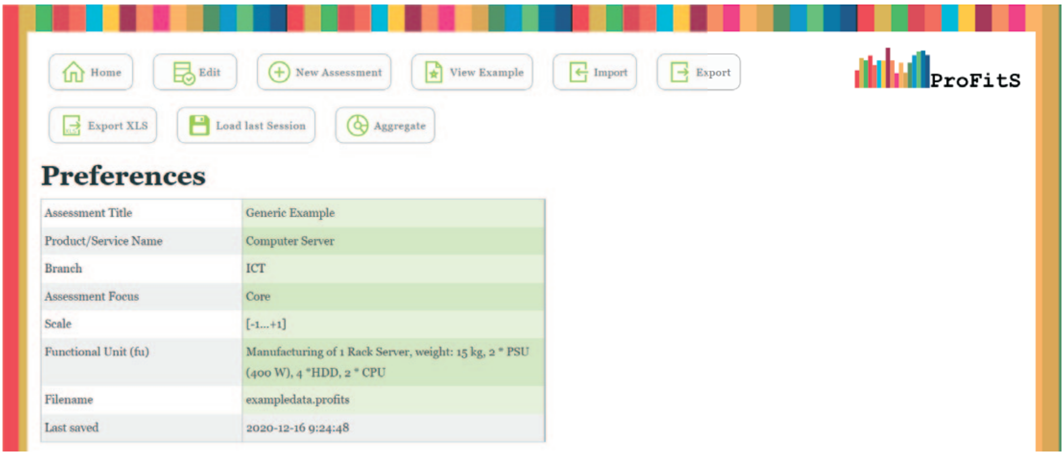
10.1 The ProFitS software

The ProFitS software combines in a single tool the evaluation methods which have been developed, thus enabling the recording of product- and company-related data, the breaking down of the manufacturing process into individual sub-steps and the graphical display of the respective sustainability contribution. The software is freely available on www.prosa.org and can be operated via an internet browser. All data entered remains locally on the user's computer and can be saved there or exported for processing in a spreadsheet programme. The user interface of the software is drawn up in English to facilitate international applicability.

10.2 Data entry

Preferences
The implementation of a sustainability analysis with ProFitS is started with the specification of the object of investigation ("assessment title" and "product/service name"), the selection of the branch ("branch") and the "assessment focus" ("core" or "comprehensive") (see Figure 11). The "functional unit (fu)" describes the object of investigation with an explanatory text, in the sense of a life cycle assessment with the specification of the system boundaries and the unit and time reference. By selecting the scale, you can choose whether the results are displayed from -1 to +1 or as points from 0 to 100. The settings can be changed subsequently

Figure 11 – Default setting on assessment (“preferences”)



Source: ProFitS software, example values

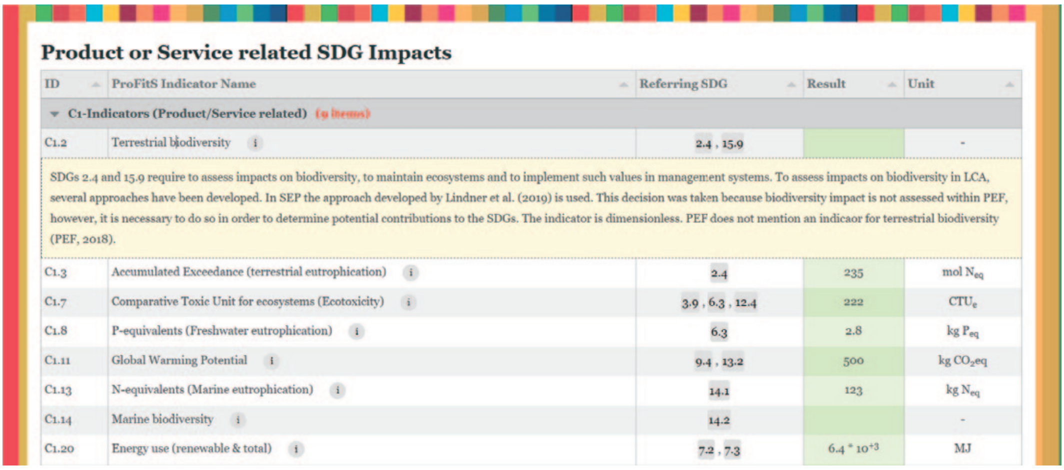
To record the sustainability impacts of a product or service, the entry of sustainability indicators is divided into three sub-steps:

- Product or service-related SDG indicators (SDG impacts: C1 indicators, see also p. 32)
- Company-related SDG indicators (SDG impacts: C2 indicators, see also p. 33)
- Benefit-related indicators (benefit analysis: B indicators, see also p. 28)

C1 indicators

The product-related C1 indicators (“product- or service-related SDG impacts”) are the results of life cycle assessments that can be entered in the first sub-step of the assessment (see Figure 12). The ProFitS software itself does not offer any support in the preparation of LCAs, but only documents the respective environmental impact categories and specifies the associated calculation methods as well as the sustainability goals addressed. Depending on which filters (“branch” and “assessment focus”) were selected in the default settings, the maximum number of 25 indicators is reduced to the number applicable to the respective product.

Figure 12 – Entry of the product-related C1 indicators

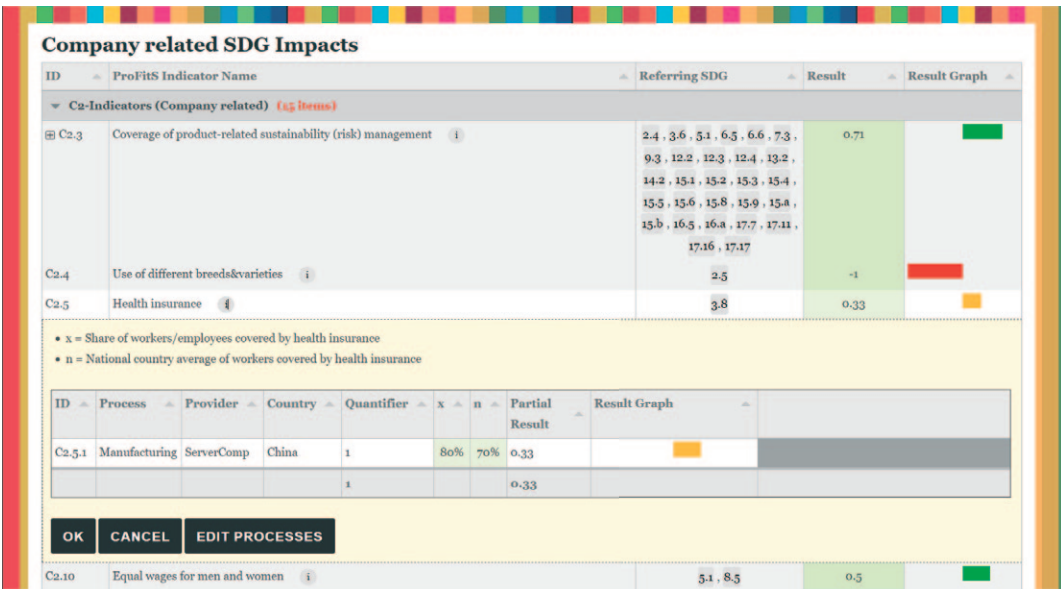


Source: ProFitS software, example values

C2 indicators

With regard to the company-related C2 indicators (SDG impacts), information on sustainable corporate governance is requested (see Figure 13). This is the second step in the process of entering data. On the basis of the evaluation of each indicator the software calculates the respective numerical contribution to the achievement of the SDGs from the indicators entered in the "result" column. The graphical representation ("result graph") immediately provides feedback on whether this contribution is negative (red bar), neutral (orange bar) or positive (green bar).

Figure 13 – Entry of the company-related C2 indicators

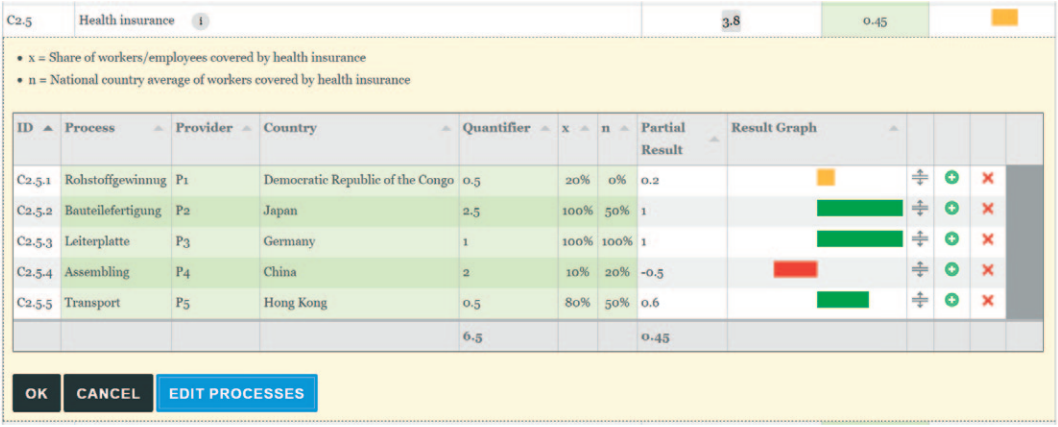


Source: ProFitS software, example values

Process editor for C2 indicators

Products are usually not manufactured by a single company, but they are made up of partial products and services from several companies (e.g. raw material extraction, transport, manufacture of semi-finished goods, processing, assembly). The sustainability impacts of a product at the company level are therefore made up of the respective partial contributions of the companies involved. To map this in the software, a so-called process editor is integrated in the C2 indicators. During the recording process it is possible to specify the number of sub-steps for the manufacture of the respective product. The process editor is started from the entry mask for each indicator via the "edit processes" button (see Figure 14). By entering "process" and "provider", the processes are clearly specified, the selection of the country documents the reference country for each national average value. The so-called "quantifier" indicates the allocation factor with which the respective process step is weighted. This can be done, for example, on the basis of mass or working hours. The overall result displayed for the C2 indicator is calculated as the sum of the weighted partial results . After confirming the entries for an indicator ("OK"), the processes for all other C2 indicators are available.

Figure 14 – Process editor for the representation of the company-related sub-steps



C2.5	Health insurance	3.8	0.45

- x = Share of workers/employees covered by health insurance
- n = National country average of workers covered by health insurance

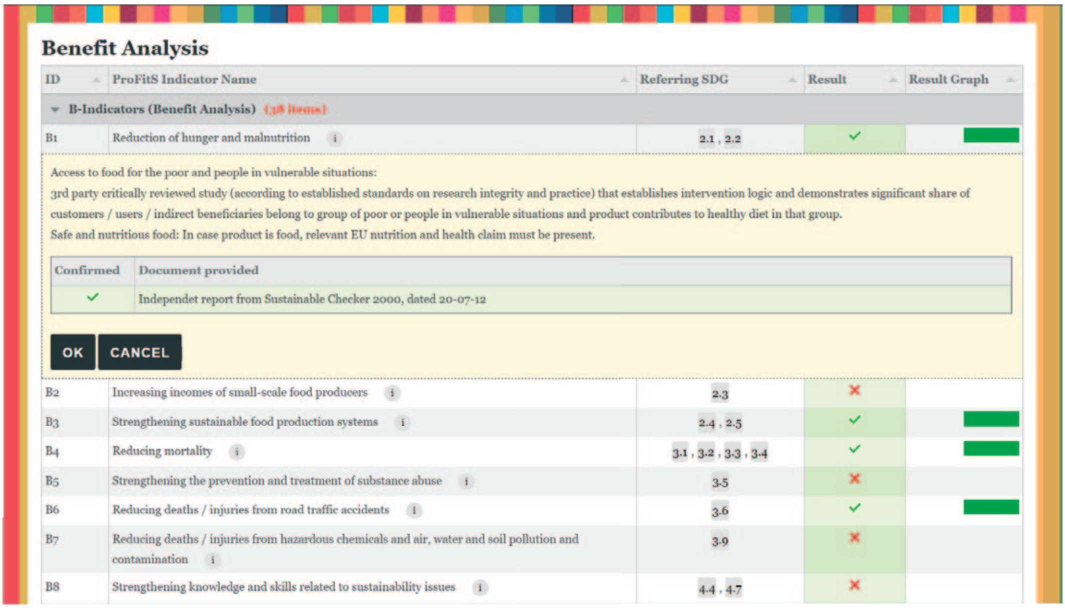
ID	Process	Provider	Country	Quantifier	x	n	Partial Result	Result Graph
C2.5.1	Rohstoffgewinnug	P1	Democratic Republic of the Congo	0.5	20%	0%	0.2	
C2.5.2	Bauteilefertigung	P2	Japan	2.5	100%	50%	1	
C2.5.3	Leiterplatte	P3	Germany	1	100%	100%	1	
C2.5.4	Assembling	P4	China	2	10%	20%	-0.5	
C2.5.5	Transport	P5	Hong Kong	0.5	80%	50%	0.6	
				6.5			0.45	

Source: ProFitS software, example values

B indicators

The third sub-step for entering the sustainability indicators for products and services is to record the product benefits in relation to the achievement of the sustainability goals (Benefit Analysis, see page 24 ff). The fulfilment of the benefit is evidenced in each case by reference to a corresponding document. In the ProFitS software, the existence of positive evidence is documented and displayed graphically (green bar).

Figure 15 – Entering the product-related benefits, B indicators



Benefit Analysis

ID	ProFitS Indicator Name	Referring SDG	Result	Result Graph
B-Indicators (Benefit Analysis)				
B1	Reduction of hunger and malnutrition	2.1, 2.2	✓	
B2	Increasing incomes of small-scale food producers	2.3	✗	
B3	Strengthening sustainable food production systems	2.4, 2.5	✓	
B4	Reducing mortality	3.1, 3.2, 3.3, 3.4	✓	
B5	Strengthening the prevention and treatment of substance abuse	3.5	✗	
B6	Reducing deaths / injuries from road traffic accidents	3.6	✓	
B7	Reducing deaths / injuries from hazardous chemicals and air, water and soil pollution and contamination	3.9	✗	
B8	Strengthening knowledge and skills related to sustainability issues	4.4, 4.7	✗	

Access to food for the poor and people in vulnerable situations:
3rd party critically reviewed study (according to established standards on research integrity and practice) that establishes intervention logic and demonstrates significant share of customers / users / indirect beneficiaries belong to group of poor or people in vulnerable situations and product contributes to healthy diet in that group.
Safe and nutritious food: In case product is food, relevant EU nutrition and health claim must be present.

Confirmed	Document provided
✓	Independet report from Sustainable Checker 2000, dated 20-07-12

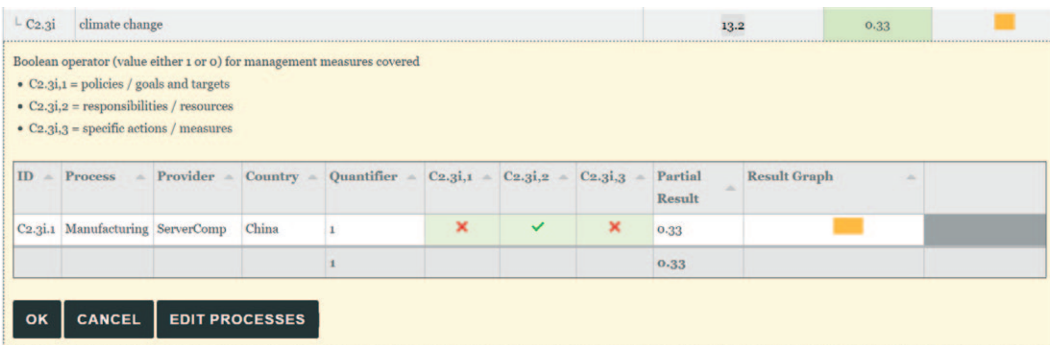
Source: ProFitS software, example values

Integrated information

In addition to recording sustainability information, the ProFitS software also serves to document the "SDG Evaluation of Products (SEP)" calculation method. For this purpose, information explaining the method and its application is already displayed when the sustainability indicators are entered.

Information on how to fill in the form
When individual indicators are selected, an information field opens with instructions on how to fill them in (see Figure 16). There, the individual identifiers are specified and explanations are given on how to enter them. The information also appears when navigating with the mouse over the input fields (tooltip).

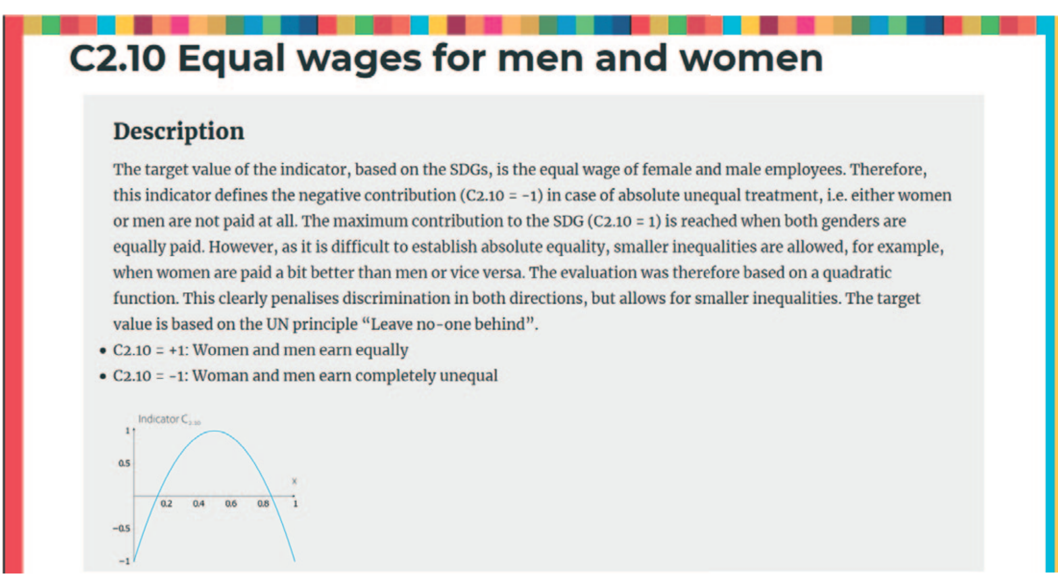
Figure 16 – Instructions for completing for individual indicators



Source: ProFitS software, example values

Indicator profile
All indicator specifications in the software are followed by an information button that opens an indicator fact sheet as a pop-up window. The fact sheets contain information explaining the indicator, provide literature references and, in the case of C2 indicators, document the calculation formula and the associated diagram showing the relationship between entered indicators and sustainability impact (see Figure 17).

Figure 17 – Indicator profiles



Source: ProFitS software

Reference to Sustainable Development Goals (SDGs)
By definition, the sustainability indicators make a positive or negative contribution to the achievement of the Sustainable Development Goals (SDGs). The name of this SDG is indicated by a further information button, which is located next to the sustainability indicators in the "referring SDG" column. Clicking on this button opens a pop-up window in which the SDGs are listed in plain text and the corresponding SDG logo is shown (see Figure 18).

Figure 18: – Information on the referred sustainability goals (SDGs)

Source: ProFitS software

Other functions of the software
The software is equipped with a menu with which other functions of the software can be called up. An overview of the menu buttons is shown in Figure 19. The names are self-explanatory. The "export" button transfers the user entries to a text file that can be saved locally. The file name is marked "*.profits" and can be renamed by the user. It is a json file (JavaScript Object Notation) in which the data is stored as structured readable text. The file can be reloaded from the local hard disk into the ProFitS software at a later time via the "**import**" button.

A second export option is the "**export XLS**" button. This creates a file that can be opened directly with a spreadsheet programme (e.g. Open Calc or Excel). The results are documented in the xls file, but not the calculation formulae. The xls file is suitable for further processing of the data, for example for creating graphics, but not for re-importing the data into the software later.

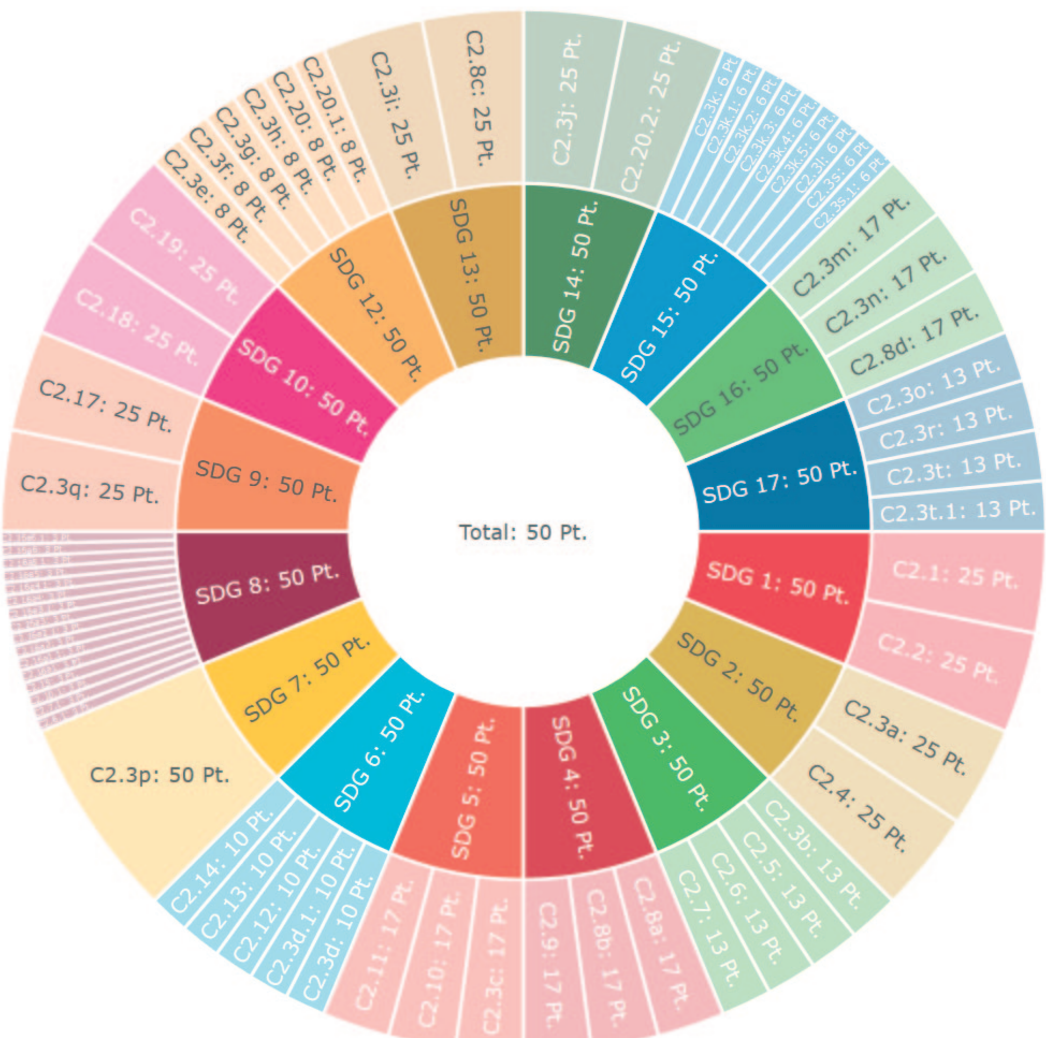
Figure 19 – Menu buttons of the ProFitS software

Menu button	Function
Home	**Show home page**
Edit	**Start or continue data collection**
New Assessment	**Delete or restart data collection**
View Example	**View Example**
Import	**Import local assessment file (*.profits)**
Export	**Export recorded data for local storage (*.profits)**
Export XLS	**Export recorded data as spreadsheet (*.xls)**
Load last Session	**Restore previous session**
Aggregate	**Aggregate data to individual SDGs (experimental)**

Source: ProFitS software

Another possible function is the "aggregate" button. This offers the possibility for a two-stage summary (aggregation) of the scores of the indicators to the respective SDGs (1st stage) and finally to an overall assessment of the product or service (2nd stage). However, the weighting of the different indicators among each other can only be done on the basis of an intensive weighing process, at best as a social consensus. The aggregation is therefore carried out in a simplified, equally weighted manner, i.e. each indicator makes the same contribution to the overall result. Figure 20 shows the experimental aggregation. The individual C2 indicators (C2.1 to C2.20) on the outer ring are assigned to the colour-coded SDGs (SDG 1 to SDG 17) in the middle ring. The numerical value in the middle of the graph (here as an example: 50 points) indicates the aggregated total value of the product and thus the overall contribution to the achievement of the Sustainable Development Goals.

Figure 20 – Aggregation of C2 sustainability indicators (fictitious example)



Source: ProFitS software, Example values 50 or 25 points each (Pt.)

11 Product Portfolio Analysis

PROSA Product Portfolio Analysis is used to select the product areas, business units or key products to be analysed in greater depth. If work conducted previously has already led to this selection, Product Portfolio Analysis can be dispensed with.

PROSA Portfolio Analysis involves both a classic, economically focussed Portfolio Analysis and a Sustainability Portfolio Analysis. The PROSA Product Portfolio Analysis confronts the economically determined self-perception of a company with an external perception from the sustainability perspective and from a stakeholder perspective.

Classic product portfolio analysis
In a first step, a classic Product Portfolio Analysis focussing on market and competition aspects is conducted, and aligned with the product portfolio matrix. Depending upon the company in question, different types of Product Portfolio Analyses can be carried out. The two best known are:

- the Boston Portfolio developed by the Boston Consulting Group. Here Strategic Business Units (SBUs) of the company are analysed, and a matrix chart is produced placing their relative market share in relation to their market growth rate. Depending upon the position in the chart, this leads to four types of SBU: cash cows, rising stars, poor dogs, question marks.
- the competitive advantage / market attractiveness portfolio developed by McKinsey. Here the relative competitive advantage and market attractiveness are characterized in a more differentiated fashion using several indexes, and the nine types of standard strategies are more differentiated as well.

PROSA Product Portfolio Analysis
In a second step, the PROSA Product Portfolio Analysis is carried out, which supplements the economic aspects of the Strategic Business Units (SBUs) to capture social and environmental aspects:

- Social and environmental risks in production, in business processes and in the market; captured as hotspots in the PROSA Product Portfolio – Sustainability Risks (cf. Figure 21; presented without case study).
- Social and environmental opportunities arising from product innovations, improved market position and adherence to key objectives of society, captured as benefits and eco-potential in the PROSA Product Portfolio – Sustainability Opportunities (cf. Figure 22; shown for the example of a prefabricated house manufacturer).

Special attention is given to potential new products or services. Product-related sustainability innovations can hold out the following opportunities:

- Identification of new business opportunities (markets) that were not previously recognized
- Migration into business fields that will by their very nature provide long-term opportunities
- Greater orientation to growing long-term customer wishes
- Generation of win-win situations for the company and society, and thus improved reputation of the company

A final **SWOT analysis** provides an integrated perspective on the internally perceived (economic) strengths and weaknesses and the externally perceived (social and environmental) opportunities and risks.

Work best conducted by means of a multi-stakeholder workshop
The key environmental and social sustainability linkages are best identified and assessed within a multi-stakeholder workshop. This approach delivers direct and up-to-date information and accurate appraisals of future options and positions. It would also be conceivable to con-duct a screening of product-specific sustainability linkages by means of an expert appraisal or through a strategy team within the company, but this would presuppose greater availability of quantitative data which hitherto have been difficult to obtain in order to deliver a comparable stability of results.

Involving stakeholders in the strategic phase naturally presents risks, such as confidentiality problems. Figure 22 in the annex shows three options by which to involve stakeholders, and the advantages and drawbacks of these options.

Case study: Prefabricated house manufacturer

A major prefabricated house manufacturer aims to expand its business areas in Germany. Following exhaustive market surveys and consumer research, four possible new Strategic Business Units (SBUs) are identified and are discussed with stakeholders. The PROSA portfolio analysis of sustainability opportunities results in the following assessments (cf. also Figure 22).

Standardized thermal insulation of existing buildings (SBU1)
High eco-potential (very large stock of existing buildings, energy reduction potential is very high per building and overall; major contribution to climate change mitigation); the key social objective of "creating employment / reducing youth unemployment" is promoted (benefit indicator B14), because insulating existing buildings creates many jobs in crafts companies and the construction sector; the key social objective of "enabling / increasing energy efficiency" (benefit indicator B13) is promoted because the specific energy consumption for heating is reduced significantly. When selecting thermal insulation materials, it is essential to ensure that they do not contain flame retardants of concern in order to support the key societal objective of "reducing the release of chemicals / hazardous waste into air, water and soil" (benefit indicator B23) and to enable positive contributions to "reducing waste generation through waste prevention, recyclability and reusability" (benefit indicator B24) at the end of the benefit phase.

New construction of plus-energy houses (SBU2)
Eco-potential is given, but is smaller for the foreseeable future than in the case of the thermal insulation of existing buildings, because only a few hundred thousand houses are newly built per year. The key social objective of "enabling / increasing energy efficiency (benefit indicator B13) is promoted nonetheless.

Wood pellet heating systems (SBU 3)
Eco-potential is given (wood is a replenishable resource, but limited in Germany). The key social objective of "creating employment / reducing youth unemployment" is promoted (benefit indicator B 14) because the forestry and wood processing sectors are labour-intensive. The key social objective "enabling / increasing the production of renewable energies" (benefit indicator B12) is promoted because wood is a renewable energy carrier.

Gas-fired condensing boilers (SBU 4)
Eco-potential is small and is not very promising against the background of long-term CO_2 reduction targets. Nevertheless, due to the higher utilisation of the energy stored in the fuel, a contribution is made to the key social objective of "enabling / increasing energy efficiency" (benefit indicator B13). Alternatives are electric heat pumps, possibly in combination with a PV system, or even electric heating in the case of highly insulated houses with very low heating energy requirements. Until this business field is established, gas heating with fossil gas will be phased out for climate protection reasons.

Figure 21 – PROSA "Strategic risk minimization" product portfolio

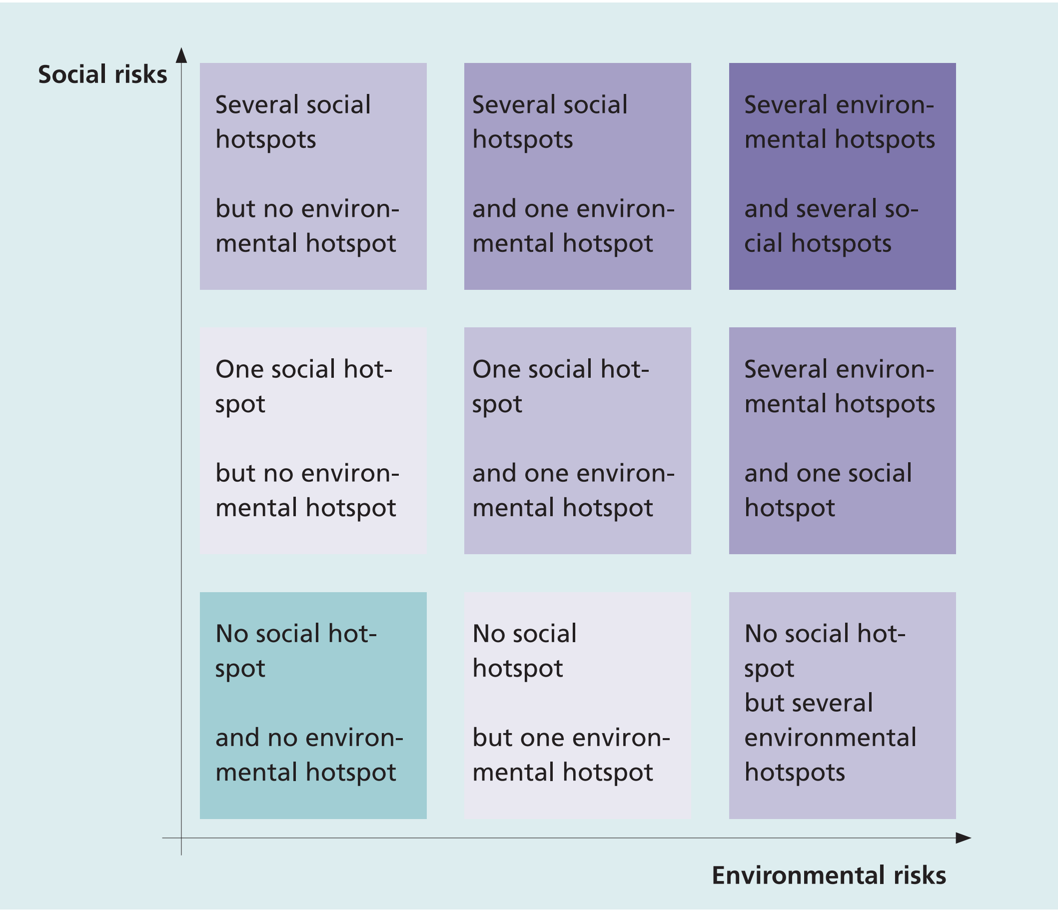
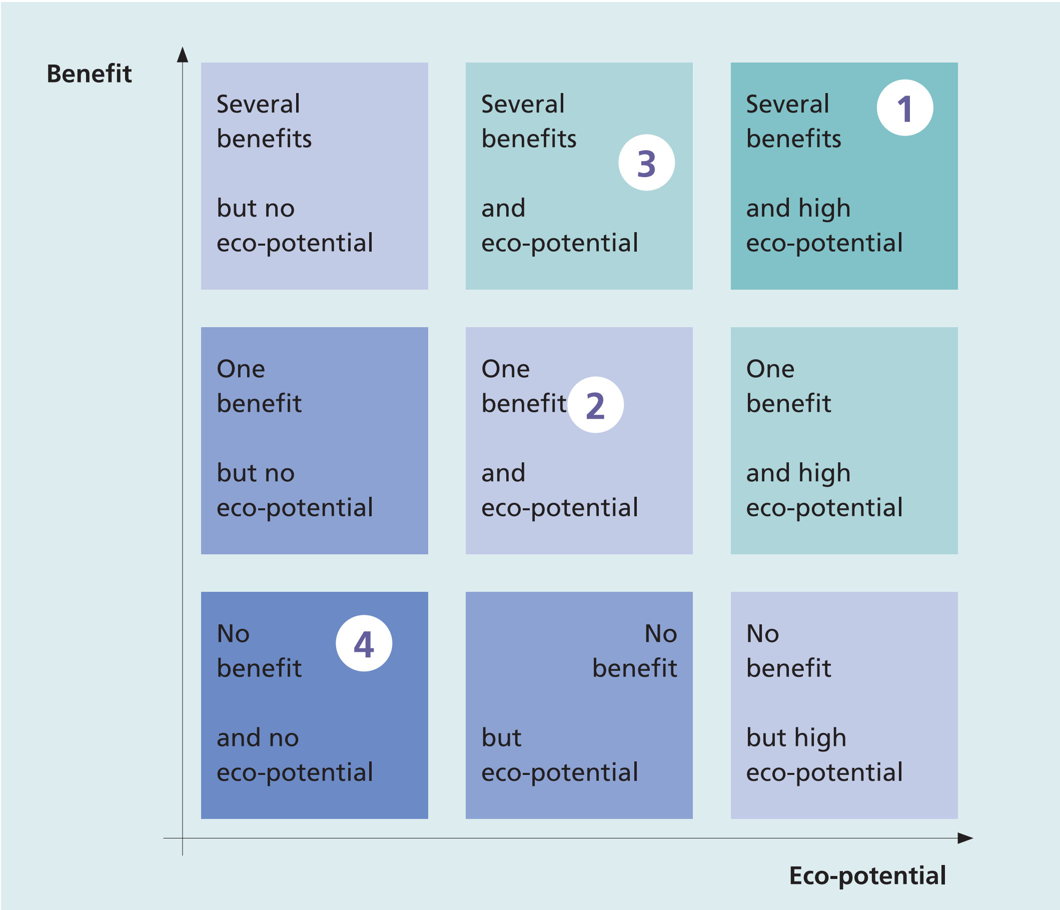


Figure 22 – PROSA "Strategic opportunities" product portfolio



o1 SBU: Standardized thermal insulation of existing buildings
o2 SBU: New construction of plus-energy houses
o3 SBU: Wood pellet heating systems
o4 SBU: Gas-fired condensing boilers

PlusEnergy houses in Freiburg (Source: Rolf Disch architects)

Annex

This section contains checklists and overviews intended as aids for implementing PROSA. In large companies there will generally be company-specific checklists for this, which can equally be used.

Actor Checklist

Before implementing PROSA there should be clarity about which internal and external actors play a role and in what form they are included or addressed. Particularly in large and international companies there is a danger that relevant internal actors are not included appropriately. The general Actor Checklist can help to establish the relevant external actors.

Figure 23 – Actor Checklist

Actor groups in general	Actor groups relevant to the product (portfolio) under study
Production companies in the chain (primary and secondary suppliers, buyers)	
Trading companies (incl. Internet trading)	
Customers (B2C, B2B, procurers, ...)	
State / administrative actors	
Financial institutions: shareholders, banks, insurance companies, rating organizations	
Media and product testing magazines	
Local residents and local actors	
Industrial associations and standards organizations	
Consumer organizations, environmental coalitions, development organizations, trade unions, product-specific associations or initiatives (such as automobile clubs, mobile phone initiatives)	

Stakeholder Involvement Checklist

Stakeholders should be included especially in sustainability-oriented strategic processes. The different possibilities are described in the following overview.

There are also transitions between the prototypical options listed here. Options 1 und 2 should be used as preparation prior to including stakeholders directly (Option 3).

Figure 24 – Stakeholder Involvement Checklist

Options for stakeholder involvement	Advantages	Disadvantages or risks
(1) Research on stakeholder positions (Internet; publications)	■ quick ■ no problems with confidentiality ■ no obligations	□ often out-of-date publications □ little chance to assess future developments and changes in position □ not possible to ask questions about content or prioritizations
(2) Conversations with individual stakeholders on the subject	■ more direct and up-to-date information ■ initial assessment of future developments and changes in position possible (depending on extent of information provided to stakeholders)	□ depending on extent of information provided to stakeholders potential problems with confidentiality □ more an exchange of positions than jointly devising sustainable strategies
(3) Direct inclusion in strategy or product panels	■ Direct and up-to-date information ■ good assessment of future developments and changes in position possible ■ large gain in creativity ■ potential for cooperative activities that support the market	□ time consuming □ problems with confidentiality □ choice of the “right“ stakeholders difficult and hard to correct □ expenses payments required, but depending on the agreement and disclosure this can also compromise the stakeholder position

Actor Cooperation Checklist

When a product portfolio is being reorganized, products developed and new marketing concepts devised, it usually requires entering into cooperative activities that may entail disadvantages as well as advantages. These should be ascertained and assessed at the start – but also during the process itself – and minimized, cf. the general Actor Cooperation Opportunities and Risks Checklist.

Figure 25 – Opportunities and risks of cooperation

Gain in know-how (know-how transfer, attainment of system expertise, common experiential knowledge, etc.)	Opportunities
Sharing of staff and investment costs (sharing qualifications, apparatus, test facilities, data processing facilities, etc.)	
Gain in time	
Joint setting of quality levels and standards	
Improving competitive position (access to new customers and markets, more direct and goal-specific market access, good for image due to attractive partners, mutual support of complementary products, etc.)	
Coordination problems (additional complexity, danger of sub-optimization, costs of compromise, friction losses, etc.)	Risks
Threat to one's own competitive situation (know-how drain, new competitors, cooperation takes on its own dynamic, etc.)	
Latent conflict situations (conflicts of distribution, company culture, conflicts over trust, conflicts over motivation, resistance to change, etc.)	

Integration Checklist

Interfaces and dependencies exist between the individual PROSA tools – Life-Cycle Assessment, Life-Cycle Costing (LCA), Social LCA (SLCA) and Benefit Analysis – which need to be taken into consideration when implementing PROSA and interpreting the results. This is necessary not only for methodological reasons, but above all in terms of drawing conclusions in practice.

Example 1: In the analysis of a new laundry dryer (especially good on saving energy, but more expensive), the Life-Cycle Costing shows that it is suitable only for large families who will use it relatively frequently. The intention had been, however, to calculate the LCA using an average household (statistically speaking 2.1 individuals), while the marketing intention had been to focus on a different target group.

Example 2: In the environmental policy appraisal of a waste treatment option for cars, the reduction of environmental impact is related to a single car part and extrapolated via the number of cars disposed of as a total positive impact; the costs, however, are calculated and extrapolated per (whole) car – this means that the costs are overestimated in comparison to the reduction of environmental impact.

Figure 26 – Integration Checklist

Feedback of the initial results from one tool to the input data and assessments for the other tools. Changes required?	☐
Functional unit defined equivalently? Different depending on target group?	☐
Outcome of Benefit Analysis taken into account when defining functional unit?	☐
System boundary and geographical scope defined uniformly or equivalently?	☐
Patterns of use defined uniformly?	☐
Dealing with different "cost bearers" in Life-Cycle Costing, but uniform "impact bearer" in Life-Cycle Assessment (namely, the environment)?	☐
Dealing with especially relevant qualitative results in Social LCA and less relevant but hard figures in Life-Cycle Costing?	☐
Are the LCA, Life-Cycle Costing and Social LCA based on significantly different data?	☐
Normalization to the same reference (e.g. number of products, branch of industry, whole national economy)?	☐
Fair and symmetrical overall evaluation?	☐
Fair and symmetrical communication of findings?	☐

Figure 27 – PROSA list of social indicators

Employees	
Safe & healthy working conditions	National framework Number of fatal accidents at work Number of accidents at work Number of recognized occupational diseases and reports on elevated health risks Workplaces associated with noise, fumes, dust, heat, insufficient illumination Basic measures and arrangements to maintain and increase safety at work Measures and arrangements to maintain and increase health at work Access to clean drinking water and sanitary facilities at work Policies and programmes to combat HIV/AIDS and/or other locally important health issues (dengue, malaria, alcoholism etc.)
Freedom of association, right to collective bargaining & workers' participation	National framework Voluntary commitments by the company in the field of freedom of association & right to collective bargaining Reports on hindering workers' organizations and their activities Rate of unionization Possibilities for collective bargaining Possibilities for bottom-up communication
Equality of opportunity and treatment & fair interaction	National framework Voluntary commitments by the company in the field of equal opportunities and treatment Reports on discriminatory practices of the company Proportion of women in management positions Proportion of disabled employees Reports on harassment and mobbing Reports on sexual harassment Measures and programmes to maintain and increase equal opportunities and treatment
Abolition of forced labour	National framework Voluntary commitments by the company on abolition of forced labour Reports on cases of forced labour as defined by the ILO core labour standard conventions No. 29 and 105
Abolition of child labour	National framework Voluntary commitments by the company on abolition of child labour Reports on cases of child labour as defined by the ILO core labour standard conventions No. 138 and 182
Adequate remuneration	National framework Average remuneration level Average level of performance-related incentives Level of corporate minimum wages Ratio of corporate minimum wages to local costs of living Number of employees in the lowest remuneration segment Average level of performance-related incentives in the lowest remuneration segment Application of a transparent remuneration system Payment of wages in due time
Adequate working time	National framework Duration of one standard working week Maximum weekly working hours Duration of weekly rest period (at least 24 hours in one stretch) Duration of annual paid holidays Possibility for individually arranged working hours Fundamental decisions to increase / maintain / reduce working hours
Employment security	National framework Portions of permanent, non-permanent, freelance employees, and workers provided by temporary work agencies and sub-contractors Labour turnover rate Regulations on dismissal protection (cancellation period etc.) Fundamental decisions on hiring or dismissing employees
Social security	National framework Evidence of breaches of obligatory social contributions Duration and level of wage continuation in the case of illness Occupational pension schemes Maternity protection and childcare Additional occupational social contributions
Professional development	National framework Enhancement of professional qualifications on the job Proportion of employees covered by training programmes Average number of training days per employee Quality of training (participants' feedback) Language courses and integration measures for foreign employees
Job satisfaction	National framework Company festivities and social events Workplace reachability (location, public transport etc.) Aesthetic design of workplaces If necessary: Provision of housing facilities fit to live decently
Local and regional communities	
Safe & healthy living conditions	National framework Fatal accidents connected to the company's activities Accidents connected to the company's activities Negative and positive health impacts for the local population Noise, fume, dust, heat and wastewater emissions Measures and arrangements to maintain and improve safe and healthy living conditions
Respect of human rights	National framework Voluntary commitments by the company in the field of human rights Reports on human rights violations related to the company's activities Forced evictions / resettlements related to the company's activities Human rights training for employees, particularly for security staff
Respect of indigenous rights	National framework Reports on interference with social, economic or cultural activities of indigenous groups Evidence of exploiting indigenous knowledge

	and cultural heritage Reports on the violation of local traditions and values Respect of indigenous development goals Measures to maintain and improve the socioeconomic basis of indigenous groups
Community engagement	National framework Information possibilities for residents System to respond to community grievances Breaches of obligations established by local political and social decision-making authorities
Maintaining & improving social and economic opportunities	National framework Influence on local resource conflicts Provision / overburdening of infrastructure facilities Provision / overburdening of welfare services Additional education facilities for local residents Impact on local economic development
Society	
Public commitments to sustainability issues	National framework Awards for engagement in social and / or sustainability issues Membership in alliances and programmes to support and promote sustainable business practices Evidence of lobbying against implementing sustainability measures Publication of a sustainability report or social report
Prevention of unjustifiable risks	National framework Use of genetically engineered products and / or promotion of activities in the field of genetic engineering of living organisms, and in relation to patenting genes, organisms and plants Handling of radioactive substances and / or support of activities connected to nuclear power and warfare Evidence of other short-, medium- or long-term risks to human security
Employment creation	National framework Labour intensity (working hours per product or functional unit) / number of employees Development of indicators 1. and 2. within the last 3 years
Vocational training	National framework Number and proportion of apprentices (in relation to the total number of employees) Enhancement of professional qualifications on the job
Anti-corruption efforts & non-interference in sensitive political issues	National framework Evidence of corrupt and / or extortionate business practices Reports on improper involvement in political activities Corporate measures to combat corrupt business practices
Social & environmental minimum standards for suppliers and cooperation partners	National framework Proven efforts to implement social and environmental minimum standards at suppliers, sub-suppliers, intermediary dealers and cooperation partners Evidence of breaches of fundamental social and environmental minimum standards at suppliers, sub-suppliers and cooperation partners
Contribution to the national economy and stable economic development	National framework Contribution to GDP Direct investments Contribution to the foreign trade balance Development of innovative products and services The sector's stability during market crisis Evidence of competition distorting business practices (monopolisation etc.)
Contribution to the national budget	National framework Contribution to the national budget (taxes paid minus subsidies received) Evidence of tax evasion
Prevention & mitigation of armed conflicts	National framework Link between economic activities and armed conflicts
Transparent business information	National framework Comprehensive and transparent business reporting and sustainability reporting Handling of inquiries on sustainability issues
Protection of intellectual property rights	National framework Reports / court sentences on breaches of intellectual property rights
Users & Consumers	
Protection of the user's / consumer's health and safety	National framework Health opportunities / risks related to product use Accidents related to product use Fatalities related to product use Findings of product safety tests (incl. any awards, labels)
Quality of product or service	National framework Quality in relation to comparable products Good service, repairability, availability of spare parts Functioning procedure to settle consumer complaints Findings of product tests (incl. any awards, labels)
Fair competition & marketing practices	National framework Evidence of agreements and practices that distort competition Evidence of fraudulent, misleading or unfair marketing strategies Prevention of high downstream costs for maintenance and disposal Proportion of advertising costs in product price Evidence of infringements of commercial advertising law (reprimands by advertising monitoring council etc.) Evidence of dubious practices to bind consumers (non-compatible software, ink cartridges etc.)
Complete & understandable product information	National framework Precise and readily understandable information (user manual, constituent substances, safe use, maintenance, storage and disposal) as basis for information-based consumer decisions
Protection of user's / consumer's privacy	National framework Indications of infringements of consumers' privacy and/or data protection rights
Enhancing the user's / consumer's social and economic possibilities	National framework Reduction of consumer costs Suitability of product to meet needs of disadvantaged groups (disabled, aged, ethnic minorities etc.) General and widespread access to products and services

References and website

ADAC (Hrsg.) (2020): Autokostenberechnung – Grundlagen für die standardisierte Kostenberechnung, ADAC e.V. , München.

Agora Verkehrswende (2019): Klimabilanz von Elektroautos. Einflussfaktoren und Verbesserungspotenzial, Berlin.

Benoît, N.C.; Traverso, M.; Neugebauer, S.; Ekener, E.; Schaubroeck, T.; Russo Garrido, S.; Berger, M.; Valdivia, S.; Lehmann, A.; Finkbeiner, M.; Arcese, G. (eds.) (2020): Social Lycle Assessment of Products and Organizations. United Nations Environmental Programme.

Eberle, U.; Möller, M.; Grießhammer, R.; Gröger, J.; Prieß, R.; Wenzig, J. (2021): SDG-Bewertung - Weiterentwicklung einer Nachhaltigkeitsbewertungsmethode auf Basis der Nachhaltigkeitsziele der Vereinten Nationen. Abschlussbericht. Witten / Freiburg.

Eberle, U. and Wenzig, J. (2020): SDG-Evaluation of Products — SEP. Nachhaltigkeitsbewertung von Produkten und Dienstleistungen anhand der Sustainable Development Goals.Broschüre. Zentrum für Nachhaltige Unternehmensführung der Universität Witten/Herdecke. Download: www.sdg-evaluation.com.

Emilsson, E. and Dahllöf, L. (2019): Lithium-Ion Vehicle Battery Production - Status 2019 on Energy Use, CO_2 Emissions, Use of Metals, Products Environmental Footprint, and Recycling. ilv C444.

European Commission (2012): Product Environmental Footprint (PEF) Guide. Download: http://ec.europa.eu/environment/eussd/pdf/footprint/PEF%20methodology%20final%20draft.pdf.

European Commission (2013): The development of PEF. Download: http://ec.europa.eu/environment/eussd/smgp/dev_methods.htm (last checked on 07.02.2021).

European Commission (2018): Product Environmental Footprint Category Rules Guidance - Version 6.3. Download: http://ec.europa.eu/environment/eussd/smgp/pdf/PEFCR_guidance_v6.3.pdf (last checked on 07.02.2021).

Finkbeiner, M.; Bach, V. and Lehmann, A. (2018): Environmental Footprint – Der Umwelt-Fußabdruck von Produkten und Dienstleistungen. UBA-TEXTE 76/2018.

Global Reporting Initiative (GRI) (2016a): Management Approach. Download: https://www.globalreporting.org/standards/media/1038/gri-103-management-approach-2016.pdf (last checked on 07.02.2021).

Global Reporting Initiative (GRI) (2016b): Grundlagen 2016. Download: https://www.globalreporting.org/standards/media/1671/german-gri-101-foundation-2016.pdf (last checked on 07.02.2021).

GRI, UN Global Compact and the WBCSD (w/o year): SDG Compass. The Guide for business action on the SDGs; developed by GRI, the UN Global Compact and the World Business Council for Sustainable Development (WBCSD). Download: https://sdgcompass.org/wp-content/uploads/2015/12/019104_SDG_Compass_Guide_2015.pdf (last checked on 07.02.2021).

Grießhammer, R.; Buchert, M.; Gensch, C.; Hochfeld, C.; Manhart, A. and Rüdenauer, I. (2007): PROSA – Product Sustainability Assessment. Beschreibung der Methode. Freiburg.

Grießhammer, R; Benoit, C; Dreyer, L.C; Flysjö, A; Manhart, A; Mazijin, B; Methot, A.L; Weidema, B. (2006); Öko-Institut and Taskforce UNEP-SETAC; Feasibility Study: Integration of social aspects into LCA. Freiburg.

HA Hessen-Agentur (2018): Strom bewegt – Fragen zur Elektromobilität. Wiesbaden.

ISO 14040: Environmental management - Life cycle assessment - Principles and framework (ISO 14040:2006); German and English version EN ISO 14040:2006

ISO 14044: Environmental management - Life cycle assessment - Requirements and guidelines (ISO 14044:2006); German and English version EN ISO 14044:2006

ISO 14045: Environmental management - Eco-efficiency assessment of product systems - Principles, requirements and guidelines (ISO 14045:2012); German and English version EN ISO 14045:2012

Muster, M.; Wolff, F.; Kampffmeyer, N.; Grießhammer, R.; Fischer, C.; Thorun, C.; Schrader, U. and Reisch, R. (2020): Evaluation des Nationalen Programms für Nachhaltigen Konsum: Ex-ante-Betrachtung und Kurzbewertung ausgewählter Maßnahmen. UBA-Texte 210. Berlin.

Rüdenauer, I. and Grießhammer, R. (2004): Ökoeffizienz-Ranking von produkt- und verhaltensbezogenen Optionen für Verbraucher. Freiburg.

Sala S.; Cerutti A.K.; Pant R. (2018): Development of a weighting approach for the Environmental Footprint, Publications Office of the European Union. Luxembourg. DOI: 10.2760/945290.

Saling, P. (2016): The BASF Eco-Efficiency Analysis. A 20-year success story. Ludwigshafen.

Steffen, W.; Richardson, K.; Rockstrom, J. et al. (2015): Planetary boundaries: guiding human development on a changing planet. Science2015; 347(6223).

Swarr, T.E.; Hunkeler, D.; Kloepffer, W.; Pesonen, H.L.; Ciroth, A.; Brent, A.C. and Pagan, P. (2011): Environmental Life Cycle Costing: A Code of Practice. The International Journal of Life Cycle Assessment 16(5):389-391.

UNEP-SETAC Life Cycle Initiative (2009): Guidelines for Social Life Cycle Assessment of Products.

United Nations (1949): Universal Declaration of Human Rights. Download: https://www.un.org/en/universal-declaration-human-rights/index.html, (last checked on 07.02.2021)

United Nations (2015): Transforming our world: the 2030 Agenda for Sustainable Development: A/RES/70/1. Download: https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_70_1_E.pdf, (last checked on 07.02.2021)

Zampori, L. and Pant, R. (2019): Suggestions for updating the Product Environmental Footprint (PEF) method. EUR 29682 EN, Publications Office of the European Union. Luxembourg. DOI:10.2760/424613, JRC115959.

Öko-Institut e.V.
Institut für angewandte Ökologie
Institute for Applied Ecology

Öko-Institut e.V.
Institut for Applied Ecology

Merzhauser Str. 173
D-79100 Freiburg
Phone: +49-761-45295-0
Fax: +49-761-45295-288
Email: info@oeko.de
www.oeko.de
www.prosa.org

Product Sustainability Assessment PROSA Produkt-Nachhaltigkeits-Analyse