SAMT
SUSTAINABILITY ASSESSMENT METHODS AND TOOLS TO SUPPORT DECISION-MAKING IN THE PROCESS INDUSTRIES

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Deliverable 1.2

Description of current industry practice and definition of the evaluation criteria

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Executive summary

The aim of the SAMT project (2015-2016) is to review and make recommendations about the most potential methods for evaluating sustainability and therein the energy and resource efficiency in the process industry. SAMT will collect, evaluate and communicate the experiences of leading industrial actors from cement, oil, metal, water, waste and chemical industries and review the latest scientific developments within the field of sustainability assessment. SAMT is a coordination and support action that promotes the cross-sectorial uptake of the most promising tools by conducting case studies, organizing workshops and producing recommendations for further implementation of the best practices in sustainability assessment.

D1.2 Description of current industry practice and definition of the evaluation criteria

The aim of the first work package in the SAMT project (WP1) is to provide an overview of existing, methods, tools and standards related to sustainability assessment, to collect best practices from different sectors of the process industry and to make recommendations about the future research and development needs. While the first report of the project (D1.1) was focused on reviewing existing methods and tools, this report aims to provide a "reality check" related to application of different methods and tools in practice.

The aim of this report is to provide an in-depth understanding of the current practice of sustainability assessment in the process industries. We applied a qualitative research method and conducted twelve interviews with seventeen people from seven companies of the process industries, including one company outside the project's consortium and subsidiaries of companies in the project's consortium. The interviewed companies represent seven different sectors of the process industry, namely cement, metal, oil, water, waste, chemical and forest industry. All interviewed companies are currently active in the field of sustainability assessment, and many of them can be considered as forerunners considering the development and implementation of sustainability assessment. Additionally, data was collected in an open expert workshop organized by the project.

By engaging with sustainability assessment practitioners and sustainability strategists in the industry, the aim was to learn how and why certain methods and tools for sustainability assessment are used (or not), how (and if) sustainability assessment is used to support decision-making, what is considered as good practice, what kind of challenges exist and what kind of expectations and needs are related to future research and development. The report points out many similarities between the interviewed companies, providing an overview of current practice and the development needs. Additionally examples from individual companies are presented, to highlight the diversity among practices and the challenges faced.

The findings of the study indicate that sustainability assessment and sustainability thinking are integrated within the daily work of the interviewed companies. Different assessment methods and tools are applied for different purposes. The assessments are conducted and reported at different levels: product, site, company, corporation or even a region. The methods most commonly applied are life cycle assessment (LCA), carbon footprint and water footprint. Carbon footprint is a method applied frequently, while the use of full LCA is more seldom. However significant differences may exist between companies, or even between different business areas of a company. Water footprint is a method which is currently in the development phase, new tools being develop and data sources tested.

The definition of sustainability assessment is at the moment broad, and includes many types of methods and tools. As different interpretations of sustainability assessment exist, providing an extensive overview of all the applied methods and tools is challenging. Besides quantitative assessment methods, several

qualitative assessment methods, checklists and other internal methods are applied in different contexts. In addition to specific assessment methods, there are certification schemes, management standards, ecolabels and ratings which all add to the diversity of work and reporting required from the companies. Thus a commonly stated challenge related to sustainability assessment was the existence of so many methods and tools. It is a challenge to keep track of all available methods and tools, and to find a combination that would be accepted by internal and external stakeholders, and would be reasonable to implement in own activities.

The variety of methods and tools is further increased by the fact that all the interviewed companies have developed their own methods and approaches, especially for calculating the carbon footprint, but for other purposes as well. Development of own approaches is due to the need to find a tool that would be adaptable to own activities and respond to the needs of data collection, decision-making and reporting. Other significant challenges relate to the needs of focusing on essential issues, and developing lighter or simplified assessment methods for daily work. These simplified methods are required since it is not possible or even reasonable to conduct very detailed assessments in every situation. However, it is commonly acknowledged that there is no “silver bullet” that would match all needs. Thus in best case, more extensive methods and the simplified methods complement each other, having different purposes but providing input to overall sustainability work and decision-making within the company.

Other challenges relate to communicating the results in an understandable way to non-experts, both in and outside the organization, and convincing (internally and externally) important stakeholders of the value of the assessments. It can be stated that the acceptance of a method or a tool lives and dies with the way the produced results are presented. While sustainability is often one of the criteria for decision-making, it is not the only criteria applied. The results need to show that they can generate value, and answer to the “so what?” question.

Good practices clearly highlighted included the use of primary data within the assessments (despite of the challenges related to data collection phase), having in-house expertise in sustainability assessment and cooperating within the industry sectors in conducting joint studies, preparing EPDs and preparing averaged LCI data for common raw materials or processes. Another example of recommended practice is the use of so called “staged approach”, in which the implementation starts from more simple, well defined and understood aspects, and continues towards more challenging topics or areas, after the first phases are implemented successfully.

The identified common development needs are closely intertwined with the challenges mentioned. There is a need to develop methods and tools that could be adapted to different industrial sectors and would be easy to implement in practice. Harmonization to the applied scopes and to the ways the results are communicated and presented would also be essential. However, the harmonization should not jeopardize the possibility to take into account and to communicate the differences between the industries and between the companies. And in all cases, the assessments should be based mostly on good quality, primary data.

In addition, there is a need for both, more comprehensive (including different aspects of sustainability) and more simple methods, focusing on selected hot spots. For example, methods or tools integrating environmental and social indicators could provide synergy, and some examples are already available. Some level of harmonization or standardization of the simple methods currently applied would also be considered beneficial. Nonetheless, standardization means balancing between the details required and the openness of the definitions. A very generic standard does not guide actions, but a very detailed one might be difficult to apply in practice.

More specific development needs relate to assessing impacts on water and biodiversity. For water footprint, a new ISO standard has been released, but there is currently a lack of local or regional data for comprehensive assessment of the water footprint. Biodiversity is another theme that is considered important and being of growing importance in the future. It is an area in which new methods, tools and

data sources would be required.

The findings from WP1 will be used to provide input and to guide the following phases of the project (WP2 and WP3). The work of the SAMT project continues in WP2 'Evaluation and selection of most potential assessment methods and best practices', in which selected methods and tools will be further assessed and tested, by using evaluation matrixes and by conducting industrial case studies in which the selected methods and tools or approaches can be tested in practice. The next steps of the project include the definition of the evaluation criteria, and the evaluation matrixes that will be used for classifying and ranking of the most potential methods and tools for sustainability assessment. The principles of the evaluation method are briefly described in the end of this report.

KEY WORDS:

sustainability, sustainability assessment, life cycle assessment, carbon footprint, water footprint, assessment practice, method development

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Contents

1 Introduction

1.1 Background

Sustainability assessment methods are needed for various industrial sectors to support sustainable technology development, decision-making and to evaluate the impacts of existing solutions, products and technologies. Ideally, sustainability assessment methods should address the environmental, economic and social aspects of technologies and cover the whole life cycle of the solutions. The assessment methods should provide robust knowledge to support decision-making, and allow comparability of the results. However, addressing all those aspects within one tool or assessment method is challenging, or even impossible. While there are aspects and indicators that are common to all process industries, sector specific methods, tools, or indicators are often required to address the specific features of each industrial sector in a fair and transparent way.

The SPIRE Public –Private Partnership (PPP)[1] brings together several sectors of process industry: cement, ceramics, chemicals, engineering, minerals and ores, non-ferrous metals, and water. All SPIRE sectors can be considered as resource and energy intensive and thus improving resource and energy efficiency are urgent issues for improving the sustainability and competitiveness of the sectors. Within the Horizon 2020 work programme, the specific and common goals listed for the SPIRE sectors are:

- A reduction in fossil energy intensity of up to 30% from current levels by 2030.
- A reduction of up to 20% in non-renewable, primary raw material intensity compared to current levels by 2030.
- A reduction of greenhouse gas emissions by 20% below 1999 levels by 2020, with further reductions up to 40% by 2030.

For the SPIRE sectors, sustainability assessment methods are crucial for evaluating the current state and the achievement of the goals related to resource and energy efficiency. For evaluating the overall resource and energy efficiency of the SPRIRE sectors as a whole, tools and indicators that are applicable for cross-sectorial assessment are required.

At the moment, several tools, assessment methods and indicators exist, but they differ in their goal and scope and are intended for different kind of use within companies, by consumers or by authorities to support policy planning and evaluation. Additionally, different methods and tools are focused for different levels of assessment: product, company, industry or society. Thus the problem is not so much the existence of proper methods and tools but rather the lack of understanding and knowledge on how they should be applied and in which context. Thorough understanding of the underlying mechanisms and calculation principles incorporated in the tool in question is often required to make a trustworthy assessment. Furthermore, it should be recognized which of the existing methods and tools are suitable for analysing resource and energy efficiency within the process industries and across the different sectors of the industry.

The SAMT project will respond to the need for cross-sectorial sustainability assessment methods by bringing together representatives of several process industry sectors, namely cement, metal, oil, water,

[1] See: www.spire2030.eu

waste and chemical industry, and collecting and evaluating the current best practices from each industrial sector, together with the latest research know-how related to sustainability assessment methods and recent activities in standardization within the field.

SAMT is funded by the Horizon 2020 work program SPIRE.2014-4: Methodologies, tools and indicators for cross-sectorial sustainability assessment of energy and resource efficient solutions in the process industry.

1.2 Some definitions

In this report we use at length the terms 'method', 'tool', and 'indicator'. The definitions we use for our particular case are as follows:

- **Method**: set of instructions describing how to calculate a set of indicators and how to asses them. Methods include official standards.
- **Tool**: working and calculation platform that assists with the implementation of a method. A tool is usually software but it could also be, for example, a paper-based check-list.[2]
- **Indicator**: a quantitative or qualitative proxy that informs on performance, result, impact, etc. without actually directly measuring it. For example, a low carbon footprint indicates a low environmental impact for the category climate change, but it does not measure the impact, it refers to greenhouse gas emissions, i.e. the environmental pressure.

Those definitions are by no means "official" but the ones we use in this project to avoid confusion. These terms are indeed used differently by many stakeholders in the scientific community, in policy, in the industry etc.

The term "toolkit" also appears in the literature, notably with the OECD Sustainable Manufacturing Toolkit and the US EPA's Lean Manufacturing Environmental Toolkits. These are in fact guidebooks and, by our definition, collections of methods and not tools.

Note that we do not use the term 'methodology'. It is often used in the literature as a synonym for method or a group of methods. We, however, consider methodology to refer to the theoretical analysis of the body of methods in a given field. This is out of the scope of this report.

1.3 Aim of the report

The aim of the SAMT project is to review, make recommendations on and develop an implementation strategy about the most potential methods for evaluating sustainability and therein the energy efficiency and resource efficiency in the process industry. The aim of the first work package in the project (WP1) is to:

- Conduct a review of existing state of the art sustainability assessment methods covering the whole life cycle of products to identify relevant methods for evaluating resource and energy efficiency in the process industries;
- Collect best practices related to applied sustainability assessment tools in the cement, metal, oil, water, waste and chemical industries, and to make recommendations about the research and development needs for applying these tools across different sectors of the process industry.

[2] Please note that minor specifications to the definitions of method and tool were made compared to the definitions presented in SAMT D1.1.

The present report addresses the objective in the second bullet point above. By engaging with sustainability assessment practitioners and sustainability strategists in the industry we tried to grasp the following aspects:

- motivations and history leading to sustainability assessment in the company,
- underlying sustainability strategy driving sustainability assessment,
- organisation and responsibilities relative to sustainability assessment,
- sustainability assessment-based information flow in decision making processes,
- methods, tools, and standards used,
- expectations from sustainability assessment in general and the SAMT project in particular.

This report is in a way a "reality check" after the first deliverable[3] that focused on methods and tools available from the literature and online. It shades light on the reasons why the industry uses some of the methods and tools reviewed in the first report, rejects or ignores some others, and has the need to develop in-house methods and tools (that could *de facto* not be included in the first report). Additionally, the principles for defining the method and the evaluation criteria that will be applied in the next phases of the SAMT project (in WP2) are presented in the final chapter of this report (Chapter 4).

Hopefully the insights gathered in this report into the process industries' experience and expectations from sustainability assessment can be useful to a broad audience of practitioners and researchers from the industry and academia, public and private process industry clients, regulators, NGOs etc. Sustainability is broadly acknowledged as a key issue across all these stakeholder groups. However, a lack of coordination, harmonisation, or even basic understanding of each other's needs and available resources can be counter-productive even though all parties are in favour of bringing sustainability assessment forward.

1.4 Method

We conducted twelve interviews with seventeen people from seven companies of the process industries, including one company outside the project's consortium and subsidiaries of companies in the project's consortium. The interviewed persons are working with sustainability assessments at CEMEX, Hydro, Neste, SUEZ environnement, BASF, Bayer, and UPM. The companies represent seven different sectors of the process industry, namely cement, metal, oil, water, waste, chemical and forest industry. Further information on the people interviewed (such as position and department) and the companies (number of employees, sector) that employ them can be found in appendix 5.1.

A detailed set of questions inspired from the classification criteria developed for the review in the first deliverable served as guidelines for structuring the interviews. These questions can be found in appendix 5.4. Chapter 2 "Industry practice of sustainability assessment" is organised in sections following the guideline's main categories of questions. We communicated the questions to the interviewees several days before the interviews so that they had a chance to prepare. Each interview took 45 to 120 minutes, depending on the availability of the interviewee.

[3] The first SAMT report (D1.1) can be downloaded from:
http://www.spire2030.eu/samt/uploads/Modules/Publications/samt_d.1.1_final_for_website.pdfhttp://www.spire2030.eu/samt/uploads/Modules/Publications/samt_d.1.1_final_for_website.pdf

The interviews were conducted during May and June 2015 in English, French, German, or Finnish. All interviews but two could be recorded, after the interviewees granted their permissions. The missing two could not be recorded for technical reasons only. Each interviewer produced a memo in English for his/her interviews based on his/her notes taken during the interview and the audio recording. These memos are not public and will remain internal to the project consortium. This report is, however, based on the empiric data (interviews, group discussions and comments) gathered during the interviews and the workshop.

A first open workshop of the SAMT project was organized in June 2015 at Wuppertal, Germany, to present the findings of the overview of the sustainability assessment methods and tools (SAMT D1.1), to discuss current industrial practices and to gather expert views related to challenges and development needs concerning sustainability assessment methods and tools. Within the workshop, group discussions were focusing on current best practices in different companies and industrial sectors. The workshop was open to all interested stakeholders, and the invitations were distributed via the project website, via the information channels of the SPIRE PPP and the SPIRE community, and via the networks of the SAMT partners. Altogether 21 persons participated to the workshop, representing both companies and research organisations. List of workshop participants can be found in appendix 5.3. Several of the workshop participants (representing the SAMT project consortium) were also among the interviewed persons.

The aim of this study was not to statistically analyse the industry practice. It was rather to get an in-depth qualitative understanding of what sustainability assessment means for each of the person interviewed and their company. The number of interviews therefore is not a limitation. On the contrary it allowed for a detailed surveying of each particular case. Chapter 2 “Industry practice of sustainability assessment” presents this diversity. Chapter 3 “Conclusions and recommendations” analyses common patterns, contradictions, hopes, and doubts regarding sustainability assessment in the process industries, as expressed during the interviews and the workshop. Chapter 4 “Definition of the evaluation criteria” provides an insight to the following phases of the project and to the work of WP2.

The interviews yielded a number of methods and tools that are used internally and sometimes commercialised by the companies interviewed. Those methods and tools missing from the first report are listed in appendix 5.2 along with some description of what they do and information on the providers. The SAMT website[4] always offers the most up-to-date list of methods and tools, together with the interactive visualisations[5] presented in the first report.

[4] www.spire2030.eu/samt

[5] http://www.spire2030.eu/samt/index.php?page=visualisations

2 Industry practice of sustainability assessment

We conducted interviews with industrial partners to learn how and why they use (or do not use) certain methods and tools for sustainability assessment, what they consider best practice, how (and if) sustainability assessment is used to support decision-making, what kind of challenges exist and what their expectations for future research and development are. This chapter reports the findings from twelve interviews with seventeen experts from the process industries, together with the findings of the SAMT expert workshop.

2.1 Purpose and organisation of sustainability assessment

This section provides some background on the interviewed companies' history of sustainability assessment and how they are organised, that is which business sectors perform sustainability assessments, which ones use the results, and for which purpose.

2.1.1 History

There are different drivers behind the interviewed companies' first steps into sustainability assessment. In general, it is difficult to define a specific starting point for sustainability assessment, as it depends of the definition of sustainability assessment. Usually, interest towards environmental impacts and sustainability has started well before adapting to certain methods or tools for the assessment. On many occasions, the underlying motivation for adapting sustainability issues in the early days has been the pressure from external stakeholders, but also the internal interest from the company, in improving own actions and performance. At first, the interest was more focused on environmental issues in general, but the discussion has widened towards social impacts, such as health and safety issues, and social impacts in the supply chain. Another, important aspect has been the interest from the customer side, which is a strong driving force. Lately, the interest from investor side has gained more importance and required more attention.

Several of the interviewed companies have been among the forerunners in developing and using sustainability assessment methods. At UPM, Neste and Hydro, the use of LCA methodology started in the 1980s. First studies related to LCA were conducted already in the late 1980s, and the development continued during the 1990s, with the methodological issues, SETAC guidelines, development of the LCA tools, and the introduction of the first ISO standards related to LCA. At UPM, the LCA software KCL-ECO (now called SULCA) was in use already in 1994. However, the interest towards environmental issues has started much earlier, actual starting point depending on the sector. In the forest sector, documentation related to environmental concerns can be found already from the 1940s, but wider interest towards the environmental issues usually started with the 1970s or 1980s. In the aluminium sector, Hydro published its first transparent environmental report in 1989, being the first company in the world to do that. At Neste, there was a strong internal focus and will on reducing the impacts caused by the fuels, which led to wider interest towards life cycle thinking and life cycle assessment in the company.

Former BASF CEO Prof. Strube and the board initiated the development on a method/tool to assess environmental and economic aspects together. It followed between 1996 and 1998 a collaboration with consulting firm Roland Berger to start methodological development on eco-efficiency (define criteria, measurements etc.) and test it in pilot projects. Until 2000 the method development continued internally before being made public (e.g. through scientific publications). The Eco-Efficiency Analysis was extended to

the SEEBALANCE® in 2005, covering social indicators as well. Today, the quantitative assessment tools are integrated in an overall toolbox assessing sustainability from different perspectives.

Starting in 2008, Bayer launched its Climate Check. Driven by the goal to analyse and reduce its greenhouse gas emissions, all energy-intensive Bayer plants worldwide have been investigated (cradle-to-gate, however with a focus on gate-to-gate) for carbon dioxide emissions and energy consumptions. On a subgroup level, the Environmental Science Division of Bayer CropScience is currently developing an alternative sustainability assessment strategy to LCA. This approach is assigned to the home and garden and professional use section of the Environmental Science business and is in line with stakeholder expectations.

At SUEZ environnement, the European Water Framework Directive in 1999/2000 kick-started the process. The Directive showed that besides carbon, nitrogen, and phosphorus, around 40 organic micro-pollutants (pesticides, heavy metals, endocrine disruptors etc.) needed to be taken into account as well. Nowadays environmental aspects are not limited to water quality (because this is defined by regulation and SUEZ must of course comply) but extend to the whole environmental footprint of a treatment plant (resulting from how the treatment is performed to achieve water quality required by the regulation).

CEMEX has deployed in 2010 to all its production sites a carbon footprinting tool previously developed and pilot-tested internally. Company-wide data are updated every two years.

2.1.2 Purpose

Different companies operating under different regulatory obligations, interacting with different stakeholders, have different reasons to invest (or not) in sustainability assessments. Nowadays, within the interviewed companies, sustainability is integrated in company actions and daily work. It is seen as a strategic choice that guides all actions. However, different companies understand the term “sustainability” differently, which leads to a variety of settings in practice. Most of the companies have set specific internal or external goals in which sustainability is included. These typically relate for example, to reducing GHG emissions, but it can relate to other issues as well, such as improving safety at work. And the outcome is reported up to the top managers. These goals guide actions within a company, and have led to inclusion of sustainability assessment as part of product and process development, and as one of the guiding principles when selecting suppliers.

Different type of screening and assessment tools are applied in development projects, to ensure that the outcome will not cause additional GHG emissions, or that it improves the environmental performance compared to current situation. While the economic issues, such as the price of the raw material, or the business potential is usually the first principle to consider, reducing GHG emissions often comes as a second principle. In some cases, sustainability experts have a power of veto, over business areas, in case any potential risks are foreseen.

“There is a very high level attention on this, which has resulted that it has been implemented in our strategy process. So that any project will have to defend why, and calculate and evaluate how they will fit in our overall objective.”

Other significant areas of application are investment decisions, marketing and communication, and answering to questionnaires and demands coming from customers. The applied methods in different situations might vary from internal checklists and simplified LCAs, to full scale Environmental and Social

Impact Assessments, full scale LCA studies, or smaller scale, more freely defined Due Diligence assessments. Thus in addition to quantitative assessment methods, the role of more qualitative assessment methods might be significant, especially in case of internal decision-making, and in selecting suppliers. The selection of the applied methods and tools depends also from potential requirements by the authorities.

"What we do when it comes to R&D and investment decisions and so on, of course we do our own calculations and our own evaluations. In those cases, we actually do a lot, especially carbon footprint and energy use, a lot of internal calculations, and let's say, simplified LCAs."

Concrete examples directly taken from the interviews and presented below can help illustrate and understand where and why sustainability assessment is applied.

For instance, for the past 8 years "impacts on sustainable development" are also required by SUEZ's clients in call for tenders, for construction or operation contracts. There is not one clear definition of what is expected. The expectations can be quite broad: safety aspects, environmental impacts etc. SUEZ uses LCAs (among other things); including through its own tool SEAShell to reply to this demand. LCA-based spider diagrams are now routinely used in tenders to show the environmental performance of more innovative (and costly) solutions than what is required from the call for tender.

In the end there are three cases where sustainability assessment (in particular LCA) is applied along the value chain covered by SUEZ environnement:

1. **Product development:** systematic LCA assessment for water treatment technology development. Two levels of R&D: initial stages (process development) can go into more LCA details, later stages (product development) use simplified tools.

2. **Site assessment:** today, different levels (e.g. full LCA or only carbon footprint) and frequencies (up to yearly) of assessment may be required depending on the contract (almost exclusively for water treatment plants because they offer room for optimisation, less so for potable water but still pursued at a smaller scale).

3. **Complete water cycle:** SUEZ almost never controls all sites on the entire water cycle in a given territory (watershed). Territorial LCAs are nevertheless proposed and conducted through SUEZ consulting. Expertise and tools were developed internally (WATERLILLY) based on a standardisation (water footprint) to which SUEZ actively participated.

At BASF, sustainability assessment is part of the corporate strategy and happens at different levels, with different methods for different purposes:

- **Large investments projects:** detailed and deep studies based on EEA, SEEBALANCE® are brought into the decision making process along with other usual parameters (economic, safety etc.). Quantitative and qualitative measurement and assessment tools are used to support decision-making processes on different levels
- **Marketing and scientific purposes:** also detailed and deep studies based e.g. on EEA, SEEBALANCE, AgBalance that are then published (as a brochure for marketing, or as journal articles with third party review etc. for scientific purposes).

- **R&D:** simplified LCA studies with high throughput to identify most promising solutions. Those studies remain internal and are not published.

At Bayer, sustainability assessments (such as LCA, streamlined or not) are integrated in a variety of ways, depending on the subgroup and business unit. At MaterialScience, raw material inputs are well known and modelled with the result that life cycle assessments are part of the development workflow. In the Life Science subgroups Bayer HealthCare and CropScience life cycle assessments are also conducted, however, holistic LCAs are more challenging due to often higher complexity and lack of primary data on the raw materials and precursors used.

The practices of the interviewed companies indicate that sustainability assessment (applying different methods and tools) is currently applied for several purposes within the companies. In addition, assessments are increasingly applied to provide input for decision-making in different contexts.

Table 1 provides some perspective to the interview findings, showing some of the results from the joint questionnaire study organized by the three SPIRE-4[6] projects STYLE, MEASURE and SAMT. The questionnaire was aimed mainly to the organizations (companies and other stakeholders) being involved with the SPIRE PPP or working closely within the sectors involved and applying sustainability assessment. The web-based survey was conducted during February and March 2015, and received altogether 122 responses. Approximately 30 of the respondents represented companies working in different sectors, the majority of them coming from the chemical sector. The aim of the questionnaire was similar to the aims of this report, namely to find out which methods and tools are applied by the industry and what kind of development needs exist. In addition, the motivations for applying sustainability assessment were asked for. Some of the findings of the survey are presented in the following sections in Tables 1, 2 and 3.

The findings from the interviews are not directly comparable with the findings from the survey. Due to the small number of respondents, the data from the survey cannot be statistically evaluated. However, it can be used to indicate the motivations of the companies for conducting sustainability evaluations and to reflect the findings of the interview in relation to a bigger number of companies. Possibly, some of the interviewed companies may also be among the survey respondents, as the survey was open to the actors of the process industry.

Nevertheless (and taking these conditions into consideration), it can be stated that the findings presented in table 1 have many similarities with the findings from the interviews, pointing out that sustainability assessment is at the moment applied in many different contexts within the process industries. All the categories included in the questionnaire and mentioned in table 1 were mentioned during the interviews as well. The survey results also point out that research and development is one of the areas in which sustainability assessment is increasingly applied (innovation driver and product development and improvement). Other significant areas of implementation include external reporting, ecolabels, requirements from the customers, requirements related to regulations and policies, and the engagement with stakeholders. However, internal aspects, such as benchmarking, are also important motivators.

[6] See: http://www.spire2030.eu/projects

Table 1: Motivations for applying sustainability assessment. Findings from the joint questionnaire prepared by the SPIRE-4 projects STYLE, MEASURE and SAMT

In general, what are the main motivations for the sustainability evaluations that you have been involved in?		
Answer Options	Response [%]	Response [count]
Product development and improvement	80,6%	25
Innovation driver	64,5%	20
Environmental labels	38,7%	12
Benchmarking	38,7%	12
Customer requirements	32,3%	10
Other (please specify)	3,2%	1
Engagement with general public	29,0%	9
Policy and regulations	29,0%	9
External reporting (e.g. CSR reports)	25,8%	8
Internal portfolio assessment	16,1%	5
Marketing	16,1%	5
Strategic planning	12,9%	4
Investors	6,5%	2
Answered questions		31

2.1.3 Organisation

The companies interviewed vary widely in size and operate in different sectors. They are obviously also organised differently, in the business as in sustainability assessment. Every company has a sustainability department of some sort at the corporate level and sustainability assessment experts closer to or within development and operational divisions. How these two levels interact, however, differ between companies.

The sustainability experts working at the corporate level can be situated either within the teams or offices in charge of strategy issues, with communication and stakeholder relations or within the research and development function. At the corporate level, the responsibilities are typically divided between different groups of experts: some focusing on environmental assessment (such as assessment methods, ecolabels, reporting and certifications), some others specialising in social issues (such as human rights, HR issues, labour, safety) and the experts related to purchases. In addition, there are experts dealing with sustainability communication.

Experts at the corporate level usually coordinate issues related to reporting. In some organisations, they have the responsibility related to method and tool development and provide business areas with support and data for decision-making and benchmarking purposes. In other organisations experts in sustainability

assessment methods are located in the businesses within the technical departments (e.g. in development) and are those developing methods and tools and providing expertise to the operational levels.

"We have a big group of people working with these topics both in our research organization and in our headquarters; the work is divided between different people. For some it means 10% of their working hours, for some it means 95-100% of their working hours."

Within different business areas or functions and at different sites there are also several persons who are working with sustainability issues. There are environmental managers, health and safety managers, and other responsible persons working at the mills and at the production sites, who are responsible of the daily issues and reporting. In all cases there are usually several, dozens or even hundreds of persons working with sustainability issues in each company. There are, however, usually maximum a dozen people in a company whose job it is to have an integrated view of all these sustainability issues, i.e. in a life cycle perspective and across all three pillars of sustainability.

"There is an environmental manager at each mill, and each mill is responsible for its own environmental performance and its environmental permits. So these issues you cannot outsource from the sites, no matter how qualified personnel you would have here at the headquarters."

2.1.4 Scope

Defining a scope for an assessment is an important part of any sustainability assessment. The scopes typically applied may vary between different methods, and can sometimes cause confusion. Definition of the scope also depends of the purpose of the assessment, or the context in which it is applied. The different scopes mentioned during the interviews are as follows:

- **Product:** water treatment technologies (SUEZ); chemical products (BASF); fuels (Neste) etc.
- **Site:** service (e.g. a given quantity of abated BOD / nitrogen / micro-pollutants at the level of a treatment plant); chemical plant, cement plant (gate-to-gate, or cradle-to-gate when considering suppliers) etc.
- **Company:** either footprinting (i.e. including upstream impacts) or corporate reporting such as GRI for which the KPIs (Key Performance Indicators) focus on direct impacts.
- **Region:** scope specific to SUEZ's assessments of the water cycle in a given local area (functional unit can be 1 m^3 of distributed water into the urban water cycle).

Each of the scopes mentioned above usually starts with raw material acquisition or production, until the end gate of the company in question. Often the application of products is considered as well. To close data and information gaps, companies are initiating collaboration along the supply chain with their business partners. End use of products is included, if it is relevant, or if the use of the products is well known, like in the case of traffic fuels. CEMEX also regularly considers the use phase of the constructions made of its cement and concrete products when it does LCA-type analyses. However, in the case of cement and concrete this is currently limited to the evaluation of well-defined projects as it is very difficult to know how the products are applied in the following phases of the life cycle and what impact they have on e.g. energy efficiency of the structure. In situations where a company has ownership of activities covering the whole life cycle, the processes related to end of life and recycling are more easily included in the assessments. This is the case with Hydro which is a so called integrated aluminium company. But this depends on the sectors.

2.1.5 Mandatory or optional?

When considering whether conducting sustainability assessment is mandatory or optional, a typical response was that it is both. In some occasions, a certain type of assessment is required by law, or by a specific customer. But on most occasions, the companies have decided to apply certain methods or tools, and to implement standards or ecolabels that require yearly reporting and audits. To be able to handle the questions received, or to report all the data that is required for communication and decision-making, using certain methods and tools has become a necessity. Some reporting is required by the authorities, for example related to environmental permits. But most often, reporting is done on a level that exceeds the demands.

"It is the policy of our company that we are committed to report these issues that the authorities are not demanding from us, and that we operate over the compliance level here."

"For any major project it is mandatory to do environmental and social impact assessment, which is more qualitative, but it is actually quite in line with legislation in different regions."

2.2 Sustainability assessment methods and tools

The first deliverable produced a long list of disparate methods and tools for sustainability assessment. This section provides a reality check: what do practitioners in the industry actually use? Did they develop their own methods and tools and why? In addition to methods and tools, practices related to data gathering and applied data sources are discussed.

2.2.1 Methods

Based on the interviews, the methods most commonly applied are LCA, carbon footprint and water footprint which has been tested or piloted by many of the companies. Of these methods, carbon footprint is the one used most frequently, whereas the use of full LCAs is at the moment not so common. Especially for carbon footprint calculations, each company has developed their own method or tool, based on existing standards and available guidelines. This has mainly been due to practical reasons; the needs to collect and operate on the data, and for modifying the approach to fit with company or supply chain specific needs.

"It is one of the challenges of this approach [sustainability assessment] that there are so many different tools, but still companies do things in their own way, and many have their own tools for that. And own practices or ways of doing things."

"Especially when the companies are working on the interface, one company acting on the upstream and other on the downstream, there is a question of who are dividing or allocating and what."

A commonly used method used in accounting for greenhouse gases is the Greenhouse Gas Protocol. It was pointed out that the GHG Protocol is a useful company based approach, at the moment missing from the list of methods and tools in SAMT D1.1. It was also discussed, whether more company specific approaches should be included in the list of methods and tools, as these are also required for sustainability assessment, and especially for reporting purposes.

"We do the assessments simultaneously at different levels: product level, mill level and corporate level, depending on the purpose. And we need all of them."

"In our perspective, we need to apply different methods and tools to get the whole picture. Because there is no tool or method that can solve everything."

Many of the companies have also tested the PEF or the OEF approach, but it was considered to be a rather complex approach, with challenges in the application, data availability and data quality, as well as in a meaningful communication of the results.

Environmental Impact Assessment and Social Impact Assessment are applied in the context of bigger projects (like investments in new operating plants), according to regulations. In case of smaller projects, often a more freely defined Due Diligence type of assessment can take place.

The companies report to different rating schemes, such as the DJSI and the CDP, which are not methods by definition, but can be used as methods for internal benchmarking purposes. In addition to mere reporting, these ratings are considered as improvement tools that allow the companies to benchmark their activities with other companies, and to analyse their own strengths and weaknesses. Another important tool applied for reporting is the GRI.

In addition, there are industry or company specific guidelines and checklists, mainly qualitative assessment methods that are applied, especially for internal screening purposes, and when evaluating potential suppliers.

"I would say that we are using a lot of sustainability assessment, but not the specific methods that you have in your document and which are very specific. We need to develop methods that fit our purpose."

"We are not putting a lot of LCA results on the market. All these results have been developed many years ago. So it is more about evaluating our value chain, and our suppliers to be sure that they have a sustainability profile with which we can live."

On many occasions, it was a bit challenging to define or make a difference between a method and a tool. Partly because both definitions are commonly used as synonyms to each other in literature, and partly because many actors have their own established terms in use. For example, LCA and carbon footprint are commonly mentioned as tools, although by the definition applied within SAMT D1.1 and this report, they are considered as methods.

It is also important to notice that the use of methods and tools may vary greatly between different business sectors or product groups of a company, as the business areas or products may operate in very different kinds of environments. In some areas, legal demands might be guiding the assessments. In some sectors or areas, customers may be very active in sending their own inquiries and questionnaires, whereas in some sectors, the situation is rather stabile, and the basic information related to the production staying more or less untouched from year to year. Thus this poses different types of demands for example regarding the frequency at which updates to assessments are required, and to the level of detail reported.

Even before environmental aspects, all companies also consider the investment and operating costs of any project. There are less, however, that specifically apply life cycle cost methods. CEMEX has a tool implementing LCA/LCCA (Life Cycle Cost Assessment) for road construction, covering concrete and asphalt

as construction material and including aspects like illumination level (depending on the reflectivity of the road), fuel consumption (depending on roughness and elasticity of the road) etc. At SUEZ environnement, when LCC and S-LCA are used, it is in research projects, not (yet) in operations. LCC and S-LCA are part of SEEBALANCE, BASF's method used (among other) to assess the sustainability of large investment projects. In other companies, methods combining environmental and social aspects were of interest, but had not been applied in practice. However, there were other (mainly qualitative) methods applied for the purpose of assessing social impacts.

One example of a method applied for managing sustainability is the Materiality Matrix of sustainability, applied by Neste, Bayer and BASF, amongst others. The materiality matrix is a method that can be used for management and prioritising different aspects of sustainability. It involves both internal assessments and engagement with the stakeholders. Some type of materiality analysis is commonly applied by different companies, especially in the context of sustainability reporting according to the GRI guidelines. In general, communication with stakeholders for determining the most important sustainability aspects, using interviews, surveys and discussions seems to be a common approach among the interviewed companies.

As mentioned already, LCA is often cited as a method but is less often implemented in practice due to high costs (time, expertise, data etc.). Most companies noted that they need lighter methods to steer their business choices while identifying the sustainability hotspots and be able to take action on them. Some companies have brand names for such methods that they developed. Some of these methods are presented briefly below.

BASF's Sustainable Solution Steering (3S) is a management-based assessment method, involving life cycle thinking but implementing LCA only in specific cases of the assessment. It is based on workshops where product managers and technical experts are gathered and discuss sustainability aspects (based on a prepared set of questions) of the products they are responsible for with sustainability assessment experts who help them think with a life cycle approach. Through a big effort involving a long series of workshops, almost all product applications were assessed with 3S and then classified into four categories (accelerator, performer, transitioner, challenged), which brought new information on a number of products and now helps the company steer the development of its portfolio. The 3S approach is also a learning process for BASF employees not yet fully familiar with sustainability issues and life cycle thinking. It is part of a process called "employee engagement": every employee at BASF should have an understanding of what sustainability means and how he/she can contribute to improve BASF's and its products' sustainability.

SUEZ's consulting branch commercialises a method called PERFORM-EE to assess and improve the environmental performance of an industrial facility in water, waste and energy, and the facility's overall environmental footprint. PERFORM-EE involves a first broad assessment of water, waste and energy aspects, followed by a more in-depth assessment of the identified hotspots, then scenario and action plans are elaborated, and the solutions implemented. Internal tools such as WATERLILLY (for the water part) are used within PERFORM-EE. To date, it is usually used at large multi-site industrial clients: it addresses both site operations (internal benchmarking etc.) and the corporate sustainability strategy (incl. reporting, KPIs etc.) of the client.

At Bayer's corporate level, the integration of sustainability in daily business and corporate strategy is reflected – amongst others – by an integrated annual report that replaces – ever since 2014 – the formerly separated financial and sustainability reports. By way of a thorough materiality analysis, targets and KPIs

have been developed for several non-financial areas of Bayer's business performance that were prioritized by internal and external stakeholders in the context of a systematic stakeholder survey.

At the subgroup Bayer CropScience the "Sustainability Excellence Initiative" is being developed since 2014. Important principles are that it should be holistic (i.e. considering production operations as well as products and services at farm level), in line with GRI reporting principles, and driven by interactions with stakeholders to define KPIs and actions to ensure focus and progress in all three sustainability pillars: economical, social and environmental.

Moreover, the Environmental Science division of Bayer CropScience is currently establishing another sustainability assessment strategy on the customer-oriented product level as an alternative to resource intensive LCAs. The new sustainability approach has been developed based on a strategic review on the different markets and is integrated in the market strategies. To support its implementation, a "sustainability framework" has been developed to assess the sustainability performance of the portfolio.

Regarding the methods applied for sustainability assessment, the findings from the joint SPIRE questionnaire are very similar to the findings of the interviews, thus strengthening the view of LCA and carbon footprint as the most common methods for quantitative sustainability assessment at the moment. According to the survey, clearly the most common methods used regularly indeed are LCA and carbon footprint. However, also Cumulative Energy Demand was mentioned by several of the respondents. Other included methods did not receive as many mentions. However, when the infrequent use is also accounted for, methods such as the water footprint, life cycle costing, cost benefit analysis, and ecological footprint are used by several of the respondents. The results presented in Table 2 show the outcome of the STYLE, MEASURE and SAMT joint survey on companies' use of methods for sustainability assessment.

Table 2: Use of sustainability assessment methods in the process industry. Findings from the joint questionnaire prepared by the SPIRE-4 projects STYLE, MEASURE and SAMT

How often are the following sustainability assessment methods used within your organisation?					
Answer Options	**Used regularly**	**Used infrequently**	**Not used**	**Unsure/ Unaware of method**	**Response Count**
Atom Economy	2	2	6	11	21
Bilan Produit – ADEME	0	2	10	10	22
Carbon Footprinting (CF)	18	2	4	2	26
Cost Benefit Analysis (CBA)	4	5	9	6	24
Cumulative Energy Demand (CED)	10	3	7	5	25
Ecological Footprint (EF)	3	5	7	7	22
Emergy Analysis	4	1	7	10	22
Environmental Life Cycle Costing (Enviro LCC)	1	7	11	6	25
Exergetic Life Cycle Assessment (ELCA)	1	0	11	9	21
Exergy Analysis	0	4	9	9	22
Integrated Sustainability Assessment	5	2	4	10	21
Life Cycle Assessment (LCA)	19	7	1	1	28

Material Input Per Service Unit (MIPS)	0	1	10	10	21
Product Sustainability Assessment (PROSA - Öko Institute Germany)	0	1	10	10	21
Process Mass Intensity (PMI)	2	1	9	9	21
Reaction Mass Efficiency (RME)	1	4	7	9	21
Social Life Cycle Assessment (SLCA)	1	5	9	8	23
Water Footprinting	4	8	6	5	23
Other					5
Answered questions					29

2.2.2 Tools

Companies doing LCA rely on established tools, sometimes with their own additions to it, such as a custom openLCA platform (BASF), SimaPro (Hydro) with upstream and downstream Excel linkages for certain applications (SUEZ environnement), GaBi (Bayer, Neste, UPM) etc. However, for carbon footprints, own tools have often been developed, and MS Excel is commonly used to collect the data and also to conduct the carbon footprint calculations. The advantages of Excel are that it is flexible and it sheets can be easily modified according to own needs. It is also easy to use (without much prior knowledge), and usually available. For full LCAs, specialised software is still preferred, as handling all the impact categories within Excel was considered too complicated.

"If new tools are very specific, it can make the communication both upstream and downstream more difficult. Excel is good since it is quite easy, since almost everybody can use it, and it is available for almost everybody, or some version of it."

"We are using more spreadsheet models or tools for these calculations, because doing carbon footprint is much more simple than the overall calculation."

The findings from the SPIRE survey can be considered consistent with the findings of the interviews conducted within the SAMT project. Among the survey respondents (N=25), the tools used regularly, and mentioned by more than 5 of the respondents were the LCA software GaBi and SimaPro. In addition, some other commercially available and free LCA software were mentioned a few times. Some of the respondents applied also internal tools or other tools that were not included in the list.

For carbon footprint and calculating GHG emissions, some sector specific tools are also available, such as BioGrace for the biofuel sector, dealing with the specific demands related to the Renewable Energy Directive (RED). In the biofuel sector, the level of detail required by the calculations has led the companies to develop their own verification schemes, such as the HVO Renewable Diesel Scheme for Verification of Compliance with the RED sustainability criteria for biofuels, developed by Neste.[7] CEMEX also uses a sector specific tool for generating EPDs: the EPD-calculator provided by the Cement Sustainability Initiative.

[7] All accepted schemes can be found from http://ec.europa.eu/energy/en/topics/renewable-energy/biofuels/voluntary-schemes.

Regarding the water footprint, the challenge at the moment seems to be that several tools (and/or databases or sources) are required, to be able to evaluate the impacts. Integrated solutions were recently released, however, such as SUEZ's WATERLILLY, an ISO compliant water footprint tool for urban water cycles and industrial sites. It is commercialised within consulting contracts.

It is also a challenge, if different tools have to be applied for different indicators or impact categories. Another aspect is that the tools should be flexible enough so that they could be easily adapted to different kinds of supply chains. Adaptability seems to be one of the problems hindering the use of some of the available tools. The tools would also have to be accepted by the customers, and by important stakeholders. The customers might also have their own assessment methods and tools that need to be applied in their specific cases, further increasing the amount of methods and tools that the companies need to deal with.

2.2.3 Data

Regarding data and data management, best practice clearly is to use a company's own data for its operations and primary data for its suppliers. The former imposes to implement a data collection scheme, usually at the site level. For sites with multiple outputs, data at the production line level would be preferable but is often not available. At UPM, a special line specific calculation system was developed in the end of 1980s due to an inquiry from a customer. Since then, the system was considered very useful for both internal and external data collection and reporting, and is nowadays a necessary tool for the company. In any case, internal data collection requires building collection tools that site operators can handle. Data collection tools need at the very least extensive built-in consistency checks.

Regarding the upstream direction, sourcing is becoming more and more relevant from a sustainability point of view. Different types of information are collected and screening methods are applied for selecting the suppliers, before any actual (quantitative) data collection takes place. Companies' sustainability experts increasingly work with the purchasing department and the suppliers: how does a company get more detailed information from the suppliers, how can they make more sustainable decision that would then benefit the company's products? Data exchange can occur, for example at the LCI level, which would not give away all process information. But even an LCI (e.g. because of some specific emissions characteristic of some process) can give away too much information. It is definitely a challenge.

The accuracy of the data applied for the upstream processes also depends on the situation. A company might have up to 60,000 suppliers, or it might even be difficult to define the actual number of the sites providing the raw materials. However, usually the data related to main raw materials is collected directly from the suppliers, and a lot of effort is used in guiding the data collection, and in collecting and verifying the data received.

Suppliers might also include small-scale farmers, families taking care of a very small land area trying to earn their living. In these cases, cooperation with a company means much more than just filling in the required data or applying for required certifications, but long-term support for the whole family and to the local community.

A commonly applied LCI-database is ecoinvent, which is used especially for additional data, such as for transports. However, the quality of the data in the commonly applied databases causes problems from time to time, as the available process data might be very old, contain erroneous figures or values, or might not reflect existing technologies.

In addition to ecoinvent, other databases applied by the companies included The Social Hot Spot Database, the TEEB database and the Quantis Water Database. The Social Hot Spot Database[8] is used (as the name implies) in hotspot analysis (e.g. to identify if certain supplier come from certain region of the world where there may be particular social issues). For methods such as SEEBALANCE more specific details on the product or sector level may be required.

CEMEX uses the TEEB database (The Economics of Ecosystems and Biodiversity)[9] for the monetary assessment of biodiversity and land use, and also water scarcity information from the World Resources Institute.

Bayer Technology Services and BASF use the Quantis Water Database. Neste has screened or tested several of the water related tools and data sources, such as the Water Footprint Network's work with province level break-down of water footprints per crop, and the different water related characterization factors, such as the water stress index (ETH Zürich based on Pfister et al. 2010[10]) and the water scarcity and stress indicators (according to CIRAIG and Boulay et al. 2011[11]).

Besides LCA databases, public service providers such as SUEZ's water, wastewater and waste businesses also require statistical data for their assessments. Public databases such as INSEE (French Statistical Institute) are used. In case the client is a public authority it may provide access to similar statistics but with a higher level of details (e.g. coupled with GIS information). In addition to LCA databases and statistics different literature sources, such as published LCA studies are searched for and applied whenever available.

A viable (even though partial) solution that is more and more applied is conducting life cycle studies with industry associations. For example, the Association of Plastic Manufacturers Plastics Europe provides a number of what they call "eco-profiles" of their products. In practice it means that one can download LCIs and EPDs for 57 products. The EPDs are reported in PDF files while LCIs are available in Excel, Ecospold, ELCD, and Umberto formats (and they come with a PDF documentation). These results come from high quality primary data and represent an average of European production. Results cannot be traced back to a single manufacturer. LCIs and EPDs also do not disclose unit process information. So no "manipulation" by third party users is possible and the LCI can be used in their original state of calculation. This and related confidentiality issues is to date still a barrier to integrating such data into some commercial databases such as ecoinvent.

2.3 Experience and expectations

Taking stock of sometimes decades of development and practice, this section provides both a look on past and current successes and challenges in implementing sustainability assessments at the interviewed companies, and insights into expectations for further developments. The section is structured under three main themes; good practices and recommendations, challenges and development needs. Each of the themes is further divided in specific sections, according to the themes discussed during the interviews and topics raised during several of the discussion.

[8] http://socialhotspot.org/
[9] See: http://www.teebweb.org/
[10] http://www.ifu.ethz.ch/ESD/downloads/EI99plus
[11] http://www.ciraig.org/fr/wateruseimpacts.php

2.3.1 Good practices and recommendations

Good practices related to sustainability assessment were discussed during the interviews and within the SAMT expert workshop. Although several different kind of practices were mentioned, three topics could be identified in which many of the mentioned good practices were related to:

- Data and data collection
- Internal knowledge in sustainability assessment and LCA
- Cooperation between industry sectors.

In the following chapters, the recommendations for good practices are presented, including both, practical tips and more general level advices. Additionally, another good practice that relates also to the purpose, approach and organization of the assessment within companies, and can perhaps be considered as one of the overarching themes of the report, concerns the need and importance to focus the activities on essential things.

Rather than aiming at a 100% complete study (which is *per se* not possible), one should concentrate on what is important and implement it in a way that the study is doable in a given time frame and that the results are later usable. In particular, social indicators can quickly become too broad and numerous to handle. Hence the utility of having first a hot spot analysis, to concentrate on the important things is clear.

"The advantages of using these, especially when talking about LCA, and the way we have been using it is really to highlight where we should focus, what are the improvement potentials, and what are the hotspots. And there it has been very useful."

Another overarching theme relates to communication of results. User-friendliness is important for the tools used to implement the methods but also for presenting the interpretation of the results. Communication is one of the topics that somehow relates to most of the themes discussed within this section, and under the following chapters describing challenges and development needs. Many of the good practices can also be considered as challenges (as they might be challenging to apply in practice), and they relate closely to the development needs.

In the following chapters, examples of good practices and recommendations related to data, internal knowledge and cooperation are discussed.

Data and data collection

"Using own data in own studies is best practice, and the best way to do it."

Collecting primary data of high quality from own activities is emphasized as a good practice, and as one of the most important things to ensure the quality of the assessments and of the results. When possible, primary data should be collected from the upstream as well, especially if the results are used as a basis for any decision-making, especially concerning specific purchased products. For products sourced from the general market, association data that can be seen as secondary data are usually very helpful. Those data representing a meaningful average might be a good alternative to improve data quality.

Data collection is also a laborious and time consuming phase of the assessments. In big companies, collecting enough data from all sites might take years. But because of its importance, many of the

recommended good practices were related to organizing data collection. However, how to organize this in practice depends from several aspects (such as the size of the company, the amount of production sites, type of production, amount of raw materials used, etc.).

Good practices highlighted during the interviews and the workshop are as follows:

- Simple tools or ways to cross-check the reliability of the data, when operators are responsible of feeding data into system, are required. ("*Never underestimate the risk of - conscious or accidental - data manipulation*").
- Avoid manual data transfer when possible, since mistakes happen easily.
- Excel has proved to be a good tool in collecting and handling the data. It is quite easy to use, almost everybody can use it, and it is available for almost everybody (or at least some version of it).
- In data collection, use units and vocabulary that are familiar for the users of the system.
- Involved people need to be introduced to the tool and why it is used.
- Use a stepwise approach: start data collection with simple things (such as energy, CO_2), and then proceed to more complicated issues, when involved people are more familiar with the questions.
- Some of the collected data might seem irrelevant at first, but the importance of reporting everything needs to be highlighted: at first some values may be insignificant, later on highly relevant, depending on the included indicators.
- Discussions with the value chain (suppliers and customers) can be an efficient tool. Instead of asking values for a sheet, describe the problems and discuss potential ways to decrease the environmental load. Simple solutions can be found. However, metrics are still needed to be able to monitor the improvements.
- Do not forget the downstream, either. Although you do not necessarily have to deal with the same accuracy there, it depends on the sector and product group in question.

Importance of internal knowledge in sustainability assessment and LCA

The highlighted recommendations also included the importance to have the knowledge related to sustainability assessment within the company. Buying or outsourcing all activities related to sustainability assessment would not be considered reasonable, as very careful knowledge of the data, processes, the industry sector, and the applied methods is usually required to be able to evaluate the quality of the work, and to interpret the results.

"A company has to know what the scope is and what the limitations are. And to be able to handle the assessments. I cannot see a situation in which all the studies or sustainability assessments would be bought from external consultants, one study from here, and another from there. That is not a reasonable solution."

"It is important to have inside the company the knowhow that is critically related to the business. That, you cannot outsource. And then we are more flexible in using the gathered knowledge in the following work."

"It is valuable to have in-house LCA-expertise and it can be managed. External consultants can be invited to verify certain parts of the procedure, to ensure the validity and suitability for communication."

However, using consultants or research institutes as additional service providers was also considered useful, and sometimes even required, as using an external party to conduct the assessment might increase the credibility of some of the assessments towards the stakeholders.

Cooperation within the industry sectors

Cooperation within industry sectors was also seen beneficial, and many of the companies have been active in joint initiatives. Examples of useful, industry specific methods (or tools) are the Environmental Product Declarations (EPDs) that are used as tools for communicating the environmental impacts of products in a harmonized way. For example the cement industry has recently worked on a joint EPD, and the paper industry has developed its own Paper Profile which has been in use for several years. It was also considered that the forerunner companies are in key position to initiate this kind of work and to enhance the cooperation within their own sectors.

Cooperation is also done through the industry associations, to produce industry or material specific LCAs for example in cases, where materials are compared against some other, competing materials, and where a joint benefit for the industry sector can be seen. Some of the industries have also produced joint LCI data sets (based on averaged, real industry data) in studies conducted or ordered via the industry associations.

In the oil sector, most of the oil companies operating in Europe carry out joint research regarding the environmental issues relevant to the oil industry within Concawe (a division of the European Petroleum Refiners Association). Examples of scientific work are the JEC studies that are conducted in collaboration between the European Commission's Joint Research Centre and EUCAR. The Well-To-Wheels (WTW) studies by JEC analyse the greenhouse gas emissions and energy efficiency of all automotive fuels and power-train options significant for Europe.[12]

Joint initiatives within different industrial sectors for defining guidelines for sustainable production were also seen as beneficial. Examples include the Responsible Care programme[13] from the chemical sector, and the Aluminium Stewardship Initiative[14], which is currently under development, aiming to produce a certification related to sustainable production in the aluminium sector. However, despite the potential benefits achieved through cooperation, sometimes the companies might have very differing views on sustainability, preventing the development of joint initiatives.

2.3.2 Challenges

The challenges discussed during the interviews and the workshop related to both, the methods and tools applied but also to organising and conducting the assessments in practice, and applying the results. While some of the challenges are sector specific, majority of the points raised are common to all experts applying sustainability assessment, despite of the sector.

A central challenge was and is to explain to non-experts what is done in a sustainability assessment, what the results mean, why they are important and why they can trust them. Introducing sustainability (all three aspects of it) into decision making process formerly dominated by economic aspects is a challenge. For that to happen one needs a solid methodological basis, good case studies, working examples showing that sustainability considerations can and will create value (in business but also in customer relations etc.).

[12] For more information, see: http://iet.jrc.ec.europa.eu/about-jec/welcome-jec-website
[13] For more information, see: http://www.cefic.org/Responsible-Care/
[14] For more information, see: http://aluminium-stewardship.org/

"I think it is also about building capacity and competence in companies. We need to start easy to trigger the interest, and to demonstrate the usability and the benefits of using these methods. And then we might create interest and market for looking into more advanced methods."

It is also a challenge to reach everyone in a large company to make sure everybody acknowledges the importance of sustainability issues. Reaching out to customers who are not aware of such issues is also a challenge. In short, besides the technical (method, data) issues, there is an important human component that is critical for the success of sustainability assessments.

"I think what is really a key for the companies to highlight is that everyone can contribute."

"So that all persons standing at the floor level at the production sites see that how the decisions they take and the way the run their things actually has an impact on the overarching targets."

Besides the central challenges described above, the more specific challenges were grouped under the following themes that were identified from the empiric data:

- Data challenges
- Methodological challenges
- Water assessments.

Many of these relate to practical issues faced as part of daily work related to sustainability assessment.

Data challenges and the" supplier dilemma"

Data availability is generally an issue, especially for newer fields. It is less of an issue for methods like carbon footprint. However, data availability might still be a challenge also for calculating the carbon footprint, especially when new or less used raw materials are considered. Water footprint is an important upcoming method for which there is still a large data gap for a number of products.

A version of the "supplier dilemma" could be identified between the SAMT industrial partners. Say a wastewater treatment plant sources for its operations reagents produced by chemical companies such as BASF. Say the plant operator (e.g. SUEZ environnement) wants to optimise the life cycle footprint of the plant and conducts a LCA. The reagent producers usually do not provide LCAs by production sites but average over their different production sites for the same product (if they disclose such life cycle information at all). This may prevent the client to optimise its own LCA if this compound is a key element. On the other hand, those data sets can be a good representative average and be a starting point for further discussions with the suppliers. One can note that other products such as concrete are different: since concrete is usually produced not far from the place it is used for construction, cement industries such CEMEX tend to provide life cycle data that correspond to a particular production site. In the forest industry, UPM also provides their customers upon request the data from their line specific calculations.

There is still a gap between what industries can disclose and the level of detail that life cycle databases require. For instance, Plastics Europe publishes LCIs but not unit process data, which is a problem for integrating their high quality data into e.g. ecoinvent. There are on-going discussions regarding how partially aggregated datasets from the industry could make it into databases such as ecoinvent. Other

databases might accept the use of system process data and benefit from the high quality of the data. Giving practitioners not the opportunity to ”manipulate” data in a way, that the underlying technology is not reflecting it, can be an advantage as well.

Methodological challenges

LCA is a powerful method with a wide range of important information as outcome. However, when it is required in tenders, problems arise with regards to comparability. Lack of transparency in the restitution of LCA results (e.g. regarding the system boundaries, cut-offs etc.) can make comparability difficult. Disclosing all data is not a solution because of trade secret issues. More detailed standards that would ensure that all practitioners use the same rules would be an improvement.

“For the public, and also for the experts, partly, it is very confusing how many different outcomes can be achieved for the same thing, using different methods or approaches. And to communicate the results, what can you say based on the calculations, when all assumptions have an impact on the results, and how can we communicate all these in an understandable manner?”

LCA is a method/tool; it does not replace a clear strategy. The strategy should lead to the choice of methods/tools, not the other way around. LCA requires investments (time, expertise etc.) and it is still difficult to demonstrate the added value (for the clients, for decision making etc.) of such a costly method/tool and thus justify its implementation at a large scale. Internal constraints (technical, production, economic etc.) often stand in the way of LCA being used to drive decision making. The other known unknown is the relevance of LCA studies on the market: Clients do say that sustainability is an important and growing parameter but is LCA or EPD etc. the best answer to their needs? They usually cannot work with multi-indicator settings. It is too complex for them. A method as the Eco-Efficiency Analysis for aggregating the data in a meaningful way might be helpful, but no agreement exists now for external types of analysis.

Considering the downstream direction in sustainability assessments raises a number of questions, such as how to make general statements for materials that are used in a broad range of applications. This is a challenge, for example, for the evaluation of cement in its applications, but for other common raw materials and end products alike.

Water assessments

Water is definitely an important sustainability issue in the near future: not only quantity but increasingly water quality. Higher water quality requires more treatment which usually means higher energy consumption. An LCA approach where downstream water quality is accounted for (e.g. removed micro-pollutants) can provide a fair assessment of treatment options. To date abated nitrogen, phosphorus etc. have a visible impact on LCA environmental indicators but potential impacts of micro-pollutants are somewhat under-estimated because human and eco-toxicity studies are not yet sufficiently available for all molecules.

In addition to water quality, temporal and geographical aspects are of great importance when assessing impacts of water usage. Temporal and river basin specific water scarcity indicators need to be included in impact assessment to account for where and when (flood or rainy season) water use takes place, and how society and environment are equipped to handle various water use pressures.

2.3.3 Development needs

The challenges and the development needs discussed during the interviews and the workshop seem to focus around certain topics that are partly intertwined:

- On the one hand, the need to develop new methods and tools that would better fit with existing needs, on the other hand the challenge of coping with the already existing (large) amount of methods and tools, and trying to find out the most potential ones for a company's own activity.
- The need to balance between levels of detail required and the amount of resources available for the assessments. Many of the companies are struggling with the various needs they have to fulfil, with diminishing resources to do that work. Thus there is a need to focus on essential things, and to apply simple methods in daily work.
- On the other hand, it is generally accepted that simple methods alone are not enough, but deeper understanding of the underlying issues is also required. After this knowledge is achieved, it is possible to operate mainly with the more simple type of assessments. In any case, the needs from the industry (having limited resources and time for implementing new methods and tools) should be taken into account in method development.
- Communicating the results in a simple way, without losing important information and without simplifying the outcome too much. The outcome of LCA (including several indicators and impact categories) is considered too complex for communicating towards non-experts. Thus there would be a need for methods or tools using a more summarized approach, but without losing too much of the information while presenting the outcome. Comparability of the outcome would also be needed, but experts are often still needed to explain the uncertainties involved, and the importance of the assumptions made.
- Developing tools that would integrate different aspects of sustainability, such as the environmental and social aspects, would be of interest, especially, if the complexity of the method does not increase too much. Overarching assessment methods and tools are in principle of interest, but even more important is the ability to apply these methods in practice.
- Additionally, methods that would be able to assess the company from a more holistic perspective would be of interest (compared to LCA based methods that are more focused on the product level and that are unable to address all needs related to assessments).
- Showing the benefits of the application of LCA studies, comparison of costs of other decision-making processes with LCA-type tools.
- Specification of tools linked with the requirements of decision-makers.

In the following, the same challenges and needs are explained with the words used by the interviewed experts, describing the situation often faced in practice:

"If you would be able to tweet your results it would be good. To tweet the LCA results of your product, or the whole corporate responsibility strategy together with the greatest achievements from the last five years. But this seems to be the direction where we are going."

"It is a good thing that new methods and tools are developed, and it is important that the existing ones are improved, but it is a challenge to keep track of them all. And to try to find out what would be the best available tool kit for our purposes? And would that be accepted by our customers? And accepted by the legal requirements…"

"We have the pressure to focus on essential things. Of course you could use all your time in developing new tools, but what would be the added value for that? Where should we focus so that good things would be achieved? And the actual activities of the company have to be developed as well, and not the assessment methods or tools as such."

"If you think about the 20-80 rule, which means that if with 20% investment you get 80% of the results right, that is usually enough for the businesses, they are not interested to invest 20+80% to get 100% of the results confirmed. In this world, there is not really room for academic LCAs."

"If you start from scratch, then these light methods might not be enough. You need to have the knowledge and the know-how first."

"It is important to understand the capacity issues of the companies, to develop tools that are efficient and easy to use, not doing it too complex."

"In the end, LCA is an oversized tool compared to what use can be made of the results in practice in the industry: it is like having a Ferrari and driving it at 30 km/h".

2.3.4 Specific development needs: water, waste and biodiversity

In addition to more general development needs, specific development needs related to water, waste and biodiversity were mentioned on several occasions (See also chapter 2.3.2). These are aspects for which either new methods, tools or data sources (or all three of them) would be considered useful. Local data are needed for topics such as water (this includes related topics such as eutrophication etc.), land use and land use change, and biodiversity. The local aspects are not yet covered enough in databases but it needs to be. Regionalised life cycle data and impact characterisation data are the core issue in Water footprint. The database suppliers need to acknowledge the need from companies and drive this work, possibly with support from the academic world (this kind of set up worked well for building the Social Hot Spot Database).

SUEZ is member of an industrial chair where they jointly supervise a dozen PhD theses aiming at improving LCA databases and mid-point impact assessment methods. The main objectives are:

- Regionalise LCA mid-point impact assessment methods. Example with eutrophication: taking into account the state of the receiving environment before the discharge.
- Temporalize LCA mid-point impact assessment methods. Example with eutrophication: taking into account the time and duration of discharge (e.g. rainy day with rain spillways bringing in an additional load of pollutants; same pollutant discharge occurring over two hours vs. two weeks).
- Further develop biodiversity indicators related to water extraction and discharge (considering different water qualities at discharge).
- Improve the mid-point impact assessment methods for micro-pollutants, which are to date insufficient and thus do not reflect enough the advantages of advanced treatment plants that can remove micro-pollutants.
- Improve LCA databases with upstream data points relevant for water treatment systems (e.g. reagents).

Development needs concerning the tools and the datasets for the water footprint were highlighted also by Neste. A possibility to combine data related to water and biodiversity was one of the points of interest.

SUEZ environnement pointed out that a "Waste footprint" (by analogy to carbon or water footprint) is needed, that is methodological development expanding what has happened to wastewater treatment with the water footprint into the waste sector. Indicators, methods are needed for characterising the resource cycle in an industry or in mutualised industries (to date very little synergies based on waste between industries on one industrial site). Tools are needed to scientifically assess the value of different industrial waste management options over a life cycle perspective (not necessarily LCA-based).

2.4 Standardization

"As more and more people are looking into sustainability issues and need to apply sustainability assessments, good standards are needed!"

This section reports the interviewees' positions regarding method standardisation: existing standards and how they work with them; whether standardisation is desirable and in which fields.

It was generally thought that the ISO 14040 and 14044 standards for LCA are good and widely used. An interviewee who was involved in the development of these standards (and others) points out that there is, however, room for improvements and updates. On the other hand, there are new standards related to biofuels and bio-based products just released or coming out (both European and ISO standards), in which the level of detail is much higher compared to the general LCA standards. It remains to be seen, how companies are able to apply those standards in practice.

"I think the general ISO standards for LCA are good in a way that they leave room for some subjectivity, and for your own consideration. Of course there are both advantages and disadvantages in these approaches, either being very strict or very open. Very strict standards might prove to be very difficult to apply."

"The challenge that I see with the ISO14040, which I know quite well from LCA, is that they are good, but they are quite open in a sense that they are more concerned about the documentation than actually about the choices you make. So in principle you can do whatever you like, as long as you tell what you do. And that can cause confusion in situations where you have a few studies studying the same things but in different ways, giving different results. And that kind of undermines the credibility of LCA from time to time."

Simpler methods are needed for sustainability relevance and hotspot analysis. As we have seen in the previous sections, such methods are already in use or being developed in the companies. Having such methods and tools standardised would be a good step forward. Methods for more detailed assessments, if needed, are to date better standardised.

Water footprint is now standardised with the ISO 14046:2014 but it has the same limitations that LCA has with regards to comparability. One could compare water footprints of the same object over time, possibly across sites, but in any case only if they are done with the same tool and the same parameters (system boundaries etc.). Further standardisation of the rendition of life cycle studies may improve comparability, however.

The standard for the integration of environmental LCA with other factors to create Eco-Efficiency indicators was defined in the ISO 14045: 2012. This standard might be helpful as well to show non-experts meaningful results in a different way than only used in the LCA.

Recently, the UNEP/SETAC Guidance on organizational LCA were released, providing guidelines for applying LCA on the company level. Similar, organizational approaches are also presented in the ISO standards ISO 14072 Requirements and guidelines for Organizational Life Cycle Assessment and ISO 14069 Quantification and reporting of GHG emissions for organizations.

A candidate for future standardisation seems to be “waste”. It is to date a very heterogeneous field where regulations are not integrated, sustainability assessment methods either do not exist or are not standardised etc. SUEZ environnement (roughly 50% of its activity is in waste) currently works on concepts and tools to port what they did with their wastewater business (water footprint method, WATERLILLY tool) to their waste business.

Regarding “biodiversity”, whatever assessment methods are developed to tackle this issue will need standardisation at some point. It is not yet clear how this will happen. There is a UNEP/SETAC working group on biodiversity but at some point it will need to be taken up by an official body such as ISO (which takes a lot of time).

Regarding social aspects, no ISO norm is in the pipeline and there is to date no initiative started for that (first question would be: in which group should it be located?!). ISO26000 Guidance on social responsibility of organizations is available, but focuses on defining environmental and social responsibility on a more general level. Some guidance would be needed in this broad field. The Roundtable on Social Metrics and the WBCSD working group provide good guidance (the latter with chemical sector specific details). An update of the UNEP/SETAC handbook on social LCA is also being prepared to make it more accessible, more detailed for practitioners.

A number of standards (beside ISO) and guidance are useful and followed by companies, e.g. the Greenhouse Gas Protocol[15]. There are further association-based standards or guidance such as the WBCSD standard on LCA, working groups on social metrics standards.

Sector or product specific guidance is also needed and useful. For example PCRs (Product Category Rules) are helpful to generate EPDs but also for LCAs.

The EU initiative PEF (Product Environmental Footprint) is on the one hand good because such as standard would help studies being comparable, but on the other hand it is also problematic because certain aspects are not in line with ISO and it has to date too many indicators (a problem to keep studies doable and manageable). Many data sets needed to assess the different indicators are not available or have low quality. Additionally, some methods are not robust enough for the generation of meaningful results.

[15] http://www.ghgprotocol.org/

3 Conclusions and recommendations

3.1 Main conclusions

This report concludes SAMT project's first work package dedicated to reviewing existing sustainability assessment methods and tools, and analysing sustainability assessment practices in the industry. Since the first deliverable[16], we have organised an open expert workshop and conducted twelve interviews with practitioners and strategists in the industry (see details in appendix 5.1, 5.3 and 5.4).

As a result we did collect methods and tools that were missing from the review in the first report. They are listed in appendix 5.2 along with a brief description. Many are tools developed in-house either for internal use only or for commercial use with the company's clients. There are expert tools specific to a company's sector of activity. But there are also additional methods of sustainability assessment already in use or in development at several of the interviewed companies. These methods respond to real needs that available methods or tools did not sufficiently address.

The need to develop company specific tools further highlights two of the challenges faced by industrial actors and all persons actively involved in sustainability assessment. Firstly, the number of existing tools for sustainability assessment is already rather high, and it is difficult to keep track of all the existing ones, trying to find a toolkit that would best serve the needs of the company and be accepted by the customers and the stakeholders. Adapting to new tools (or even updating from older ones) requires time and resources that might compete with other development actions, and cannot be conducted very often.

Secondly, despite the amount of existing methods and tools, it seems that new methods and tools would be needed. Practically all of the interviewed companies, who are active in the field of sustainability assessment, have developed their own methods, tools or approaches for assessing sustainability either in a wider sense, or focusing on selected indicators that have been considered as the most important ones for the company in question. One of the reasons behind is that there are company and sector specific requirements that cannot be easily dealt with the existing, readily available tools. Thus, the existence of company specific tools further increases the amount of existing methods and tools, and again increases the challenges related to harmonizing between the approaches, and the results achieved.

As a consequence, when considering potential methods and tools for cross-sectorial sustainability assessment, flexibility and adaptability to different types of supply chains and different kind of production sites would be essential. It is unlikely that there would be a single solution that would readily fit with all needs. Although harmonizing approaches, methods and tools is in principle favoured by all, it should not be done in a way that would not let the industry or company specific specialities be accounted for.

One sticking point in all discussions regarded whether simple but shallow or complex but deep methods are needed. The answer clearly turned out to be that neither is sufficient and both are necessary. A "staged approach" seemed to be a favoured option. A streamlined sustainability assessment method applied across-the-board helps identify where action is needed (hotspots) and may be extended step-wise with expert sustainability assessment methods to inform investment decisions.

[16] The first SAMT report can be downloaded from:
http://www.spire2030.eu/samt/uploads/Modules/Publications/samt_d.1.1_final_for_website.pdfhttp://www.spire2030.eu/samt/uploads/Modules/Publications/samt_d.1.1_final_for_website.pdf

For example, BASF developed the Sustainable Solution Steering (3S), a workshop-based method with which they assessed their entire product portfolio. Large investments, however, are assessed with the much more complex Eco-Efficiency Analysis or SEEBALANCE methods prior to decision making. SUEZ environnement developed PERFORM-EE for multi-site industrial clients that implements a "staged approach": a broad assessment of water, waste and energy aspects followed by in-depth assessments of identified hotspots using SUEZ's own expert tools. The method also elaborates scenarios and action plans, along with the monitoring of solution implementation. The Environmental Science division of Bayer CropScience is currently developing a "sustainability framework" that is an assessment tool based on selected relevant criteria to be systematically applied.

Some companies may—in a similar approach but for different reasons—have built up a solid expertise in and a database of detailed assessments, only to use it today as a compass to direct their use of simplified methods. Some of the interviewed companies, for example, have been actively engaged in developing the LCA method since the 1990s and, after several years of extensive studies, have moved to using mainly simplified methods in daily work. On special occasions, extensive LCAs might still be conducted, but mainly the focus is on selected indicators, like carbon footprint. Thus the hotspots related to the production and to the value chains have been identified in earlier studies, leading the companies to focus on most important indicators or phases of the life cycle. This is possible especially for companies or sectors who work with basically the same raw material, or mix of raw materials, from year to year, such as the aluminium or the forest industry. Although the focus in sustainability assessment has changed and widened during the years, there are some aspects in production that remain the same. Focusing on simple methods is also due to the resources required for conducting extensive assessments, the cost of the assessments conducted and to the wide spectrum of sustainability aspects that need to be considered, applying several kinds of methods and tools.

The previous paragraphs distinguish between intrinsically "simple" and "complex" methods. Equally important is how this complexity is perceived by two key actors: the practitioner of the method and the recipient of the results. The latter case—especially when the recipient is not an expert—is extremely important. Acceptance and usefulness of a method or tool lives and dies with the way the results it produces can be presented. In the industrial context, sustainability assessments need to show that their results can generate value. To put it in the words of several of the interviewees, the information generated from the results need to answer the "so what?" question. Value is not only to be understood as business value (sales increase, cost reduction etc.): non-financial "values" such as reputation, relationship to suppliers or customers are also important.

Among the "complex" methods mentioned in the interviews, we cannot avoid mentioning Life Cycle Assessment (LCA) that seems to be in a love-hate relationship with the industry. In brief, most of the interviewees seemed to agree that LCA is a very useful but costly method whose raw results are usually not sufficient as a value proposition. There are different drivers behind using or not using a method such as LCA:

- It may be a clear demand from the clients (e.g. LCA demanded in calls for tender for wastewater treatment plants—construction and operation—in response to which SUEZ environnement developed its own specialised LCA tool SEAShell).

- It might be required by the authorities. In the biofuel sector, LCA is included in the directives related to accounting for GHG emissions and the assessments are verified as part of yearly audits, conducted by external experts.
- It may be integrated in the corporate strategy. BASF's Eco-Efficiency Analysis, SEEBALANCE and AgBalance, for example, extends LCA with economic and social life cycle assessment and aggregates selected resulting indicators into a single metric that allows to compare and decide between options based on one integrated indicator.
- It may be useful to address topics expressed in stakeholder surveys. For example Bayer CropScience is currently developing a holistic method referred to as "Sustainability Excellence Initiative" which attends to environmental, economic and social aspects at different life cycle stages of CropScience' operations and beyond (e.g. at farm level).

An often cited limitation to LCA involves working with suppliers: in many cases data provision is strictly limited by trade secret. An existing work around involves industry associations. Market average LCAs are generated with consultants using high quality primary data. Not all data can, however, be disclosed and results are available as LCIs only, not unit processes, which makes them too aggregated for usual LCA databases (let alone other confidentiality issues).

Availability of general LCA databases was considered important, since the whole life cycle can rarely be covered with primary data. In addition to confidentiality of the data, the sheer amount of data required for a full life cycle assessment is a challenge, and it might take years to collect.

3.2 Recommendations

One of the best practices highlighted by the interviewed experts related to the use of primary data regarding own activities, and to the upstream processes, as far as possible. This was considered as the best and only way to increase the quality and reliability of the results, and was considered essential, in all cases where results are used for any decision-making. However, several challenges relate in the data-collection phase, which is perhaps one of the most laborious phases of conducting the sustainability assessments. Most of the companies had developed their own approaches and tools for data collection. This also seems to be an area where exchange of knowledge on ways to organize data collection might be fruitful, as many of the challenges are similar, regardless of the sector in question.

Whatever the methodological approach may be, it must first convince internally of its value for the company. To that end, a limited number of in-depth successful case studies and/or a larger number of working examples based on a streamlined, less-resource intensive version of the method/tool are needed. The importance of this approach to success is underlined in all companies interviewed.

A way to lower the barrier to entry, especially for data-intensive methods such as LCA (unless one has unlimited resources for training and accompanying with experts), is to implement a staged-approach where data collection starts with well-known and accepted topics (even for non-sustainability practitioners) such as energy and carbon footprint or is coupled with existing data collection schemes such as social data being gathered by the HR department for its own purposes of for GRI-type corporate reporting. When this is in place, less routine data can be collected for further assessments. In any case, the results of the assessments should be presented at a level of complexity and specificity adapted to the recipient's expertise and needs.

3.3 Future research needs

We saw in the previous section that a “staged approach” of sustainability assessment seems to be a viable option for the industry. While a number of methods at the complex and resource intensive end of the spectrum are standardised (LCA, eco-efficiency, carbon footprint, water footprint), simpler methods applicable at a larger scale are developed separately by companies. All interviewees clearly expressed that some level of standardisation of these simpler methods is needed.

Generally, all agreed that standards are useful. Even already standardised methods such as LCA could benefit from a further level of standardisation, especially in the way LCA studies are rendered and results are presented. A lack of standardisation in this domain reduces the transparency of studies (e.g. regarding system boundaries, allocation procedures), which in turn hampers comparability. This can be a serious issue when, for instance, LCA studies are required in a call for tender and the client compares the submitted tenders to decide which technology to buy. It also affects acceptance from non-experts, which is critical for any method to take off. On the other hand, standardization would need to balance between harmonization and flexibility, since a standard with no room for assumptions might prove impossible or at least very costly, to apply in practice.

Whether simple or complex, methods and tools of sustainability assessment are increasingly horizontally integrated, meaning that they attempt to consider all three pillars of sustainability (environment, economic, social). It could be said that using an integrated method at the same time increases and decreases the complexity of the method (or the tool). On the one hand it might be simpler, if many of the indicators and aspects of sustainability could be assessed and reported within the same method or tool. On the other hand, it might increase the demands related to handling the data, and to interpreting the results.

The social aspect is gaining momentum in methods such as social LCA and corporate reporting such as GRI. Initiatives exist that provide guidance such as the Roundtable on Social Metrics and the WBCSD working group (chemical sector specific). An update of the UNEP/SETAC handbook on social LCA is being prepared to make it more accessible, more detailed for practitioners. Such coordinated actions are very useful for such rather new topics. Standardising approaches does not necessarily mean developing an ISO standard, which in any case takes a long time, and for which a global consensus might be very difficult to achieve.

At first glance, the environmental side of things seems better taken cared of, especially when methods and tools for quantitative sustainability assessment are considered. It should also be noted that although principles of environmental and social sustainability are integrated within the company actions alike, in many companies, environmental and social aspects of sustainability are handled by different experts and with different methods. This is mainly due to practical reasons: the wide spectrum of issues and impacts that need to be considered related to both aspects. In addition, most of the experts interviewed in the context of this study were working mainly on the environmental issues, which have an impact on the outcome of the report.

A success-story is the approach to greenhouse gas emissions with the standardisation of the carbon footprint and the Greenhouse Gas Protocol, both widely applied methods within all of the studied industry sectors. The wide implementation of the carbon footprint is also due to the general interest in climate issues, and to the widely accepted need to reduce greenhouse gas emissions.

The water footprint also recently was defined in an ISO standard (ISO14046). An ISO Technical Specification with practical application examples is in development (ISO14067). However, with water-related issues gaining importance, different data needs are surfacing: the need for regionalised, local data. Compared to carbon footprint, the need for localised data increases the challenges related to applying the water footprint method in practice. At the moment, there seems to be a lack of sufficiently detailed tools or databases that would allow reporting a full-scale water footprint. This is why a company like SUEZ environnement has developed and is commercialising an ISO compliant water footprint tool for urban water cycles and industrial sites, while at the same time partnering up with universities to supervise PhD theses on regionalising and temporalizing LCA databases and mid-point impact assessment methods involved in the water footprint.

Biodiversity is generally perceived as an upcoming issue. Methods to tackle it (beyond the land use proxy) still need to be developed and will require some standardisation. Localised data will or is already needed to address this topic. A joint effort of database providers, industry, and academia is going to be needed to generate, organise and distribute regionalised data.

To sum up, the challenge lying ahead according to the interviews is manifold. There is not one silver bullet method, no matter how comprehensive: standardised streamlined (simple) methods are also needed. They need to be compatible with more complex methods, including the data they use, that has to be of high quality. The way results are presented—especially depending on the target audience—is critical to acceptance and comparability across companies. Methods and tools will always, in practice, be somewhat adapted to each industrial case to which they are applied. Finally, it is a fact that resource-intensive methods and tools producing results for which there is no clear demand from clients or regulators have little chance to spread. However, exchanging experience between companies, stakeholders etc. may help to see some methods' and tools' value propositions that were overlooked at first sight.

In addition to possibilities for benchmarking own activities (regarding both practice and performance related to sustainability assessment), interviewed companies are hoping for opportunities to exchange experiences, since the companies are constantly looking for new ideas and possibilities to further develop their processes. In the best case, experiences of other practitioners can provide useful tips and motivation for tackling the challenges and development needs faced in conducting the assessments. In the long run, it may open up natural opportunities for exchange of ideas and cross-sectoral learning and cooperation.

3.4 Next steps in SAMT

The aim of the first work package of the SAMT project was to prepare an overview of existing sustainability assessment methods, tools and standards, and to describe the current industrial practice related to use of sustainability assessment. The main outcome of the work was reported in D1.1 and in this report. The work continues in work package two, in which selected methods and tools will be further assessed and tested, by using the evaluation matrixes and by conducting industrial case studies in which the selected methods and tools or approaches can be tested in practice, and in a cross-sectorial environment. The findings from WP1 will be used to guide the following phases of the project, and for preparing the final recommendations that are a task of work package 3. The next steps of the project include the definition of the evaluation criteria, and the evaluation matrixes that will be used for classifying and ranking of the most potential methods and tools for sustainability assessment in the process industry. The principles for definition of the evaluation criteria are briefly described in the following chapter 4.

4 Definition of the evaluation criteria

4.1 Introduction

The aim of the evaluation criteria is to provide a method that allows evaluating the suitability of the tools, methods, and indicators for assessing sustainability in the process industry. The tools, methods, and indicators collected in the first phases of the project, and considered as most relevant ones considering the SAMT project objectives, are going to be classified in WP2 based on the results of the assessment. This assessment is going to be performed according to the method that is presented below, which takes its basis from RACER method (EC, 2005 and 2009).

4.2 Method

In 2005 the European Commission published the first version of the Impact Assessment Guidelines (1). In this document the European Commission defined a series of steps to follow when performing an impact assessment. Specifically, these steps are:

1) Identify the problem
   - Delineate the extent of the problem
   - Identify the key players/affected populations
   - Establish the causes
   - Etc.
2) Define the objectives
   - Set objectives that correspond
3) Study the policy options
4) Identify the kind of impacts
5) Compare the options
6) Identify key indicators

In the second step, after identifying the problem, the definition of the objectives is targeted. For this purpose, the guideline establishes that the objectives should be directly related to the problem and its root causes and that they should also be set in hierarchical order and become increasingly detailed or SMART. In this step the guidelines define what they consider as “SMART” objectives:

- ✓ **Specific:** objectives should be precise and concrete enough not to be open to varying interpretations. They must be understood similarly by all.
- ✓ **Measurable:** objectives should define a desired future state in measurable terms, so that it is possible to verify whether the objective has been achieved or not. Such objectives are either quantified or based on a combination of description and scoring scales.
- ✓ **Achievable**: if objectives and target levels are to influence behavior, those who are responsible for them must be able to achieve them.
- ✓ **Realistic:** objectives and target levels should be ambitious – setting an objective that only reflects the current level of achievement is not useful – but they should also be realistic so that those responsible see them as meaningful.
- ✓ **Time-dependent:** objectives and target levels remain vague if they are not related to a fixed date or time period.

In the second version of the Impact assessment guidelines of the European Commission (2) this description of how to define SMART objectives is also included. Moreover, it is mentioned that SMART objectives are needed to define good indicators. It is important to note that they are talking about defining indicators that are useful to monitor progress and evaluate the extent to which you have achieved your objectives in the context of policy.

In the "Impact Assessment Guidelines" RACER method was also defined. RACER is an evaluation framework applied to assess the value of scientific tools for use in policy making. The European Commission specifically developed RACER to assess indicators. RACER stands for relevant, accepted, credible, easy and robust (1 and 2).

RACER means:

- ✓ **Relevant** – i.e. closely linked to the objectives to be reached
- ✓ **Accepted** – e.g. by staff and stakeholders
- ✓ **Credible for non-experts**, unambiguous and easy to interpret
- ✓ **Easy to monitor** (e.g. data collection should be possible at low cost)
- ✓ **Robust** – e.g. against manipulation

The basis of RACER method, adapted to SAMT project needs, are taken into account when defining the assessment matrixes that will be used to conduct the classification of indicators, methods and tools, according to their suitability for the objectives of SAMT.

It is important to note that in case of SAMT, the objectives to fulfil with RACER method are to identify the suitability of the methods, tools and indicators for:

- Decision making in the process industry
- Assessing resource and energy efficiency
- Making cross sectorial assessments
- Assessing the whole life cycle
- Assessing economic, environment and social issues

and not for assessing indicators with policy making purposes as was initially thought for RACER. For each of the RACER criteria several assessment categories are defined according to SAMT objectives and a criterion for assess each of them is established. In the assessment process, each criterion could be either "Fully achieved", "Partly achieved" or "Not Achieved" and, depending on the result, could have 2, 1 or 0 scores respectively.

Only the methods from the state of the art that fulfil next criteria are going to be assessed:

- Methods that provide results to support decision making
- Methods that are relevant for evaluating resource and energy efficiency
- Methods with a life cycle perspective
- Methods that are adaptable to different applications

This means that for the methods collected in the state of the art that do not fulfil these criteria, RACER method is not going to be applied and so, are not going to be part of the classification.

Moreover, and in order to have more information about the methods, tools and indicators that are being assessed, we are going to start providing some useful information for making classifications before the assessment:

- Sectors covered: Cross sectorial, multi-sectorial, sector specific
- Addressed aspects: social, environmental and/or economic
- Level of assessment: product, company, industry or society, upstream and downstream
- Costs

After these two important steps, RACER method adapted to SAMT can be applied.

It is important to note that the method has been adapted to the purposes of the SAMT project and needs to be validated by applying it. The first version of the evaluation criteria was presented and discussed during the SAMT open workshop in June 2015. Since then, further work for defining the criteria and to include the comments received from workshop participants and industrial partners was conducted. However, the internal evaluation and testing of the first versions of the evaluation criteria pointed out that several test cases are required before the definition of the final criteria can be done, to make sure that the applied method is robust enough. Thus, the criteria will be further defined and modified while conducting the assessment, and when it is seen what works in practice. As a consequence, the final version of the criteria will be published as part of the following SAMT deliverable D2.1 `Best practice solutions: Tools, methodologies and indicators for sustainability assessment', together with the results of the assessment.

5 Appendices

5.1 General information on the companies and people interviewed

For each company, people are listed in chronological order of the interviews. Numbers are used when more than one interview took place with the same company. People sharing an interview number were interviewed together.

Table 3: Methods for sustainability assessment (short names, full names, and literature sources)

COMPANY	EMPLOYEES	SECTOR	GEOGRAPHY	PEOPLE INTERVIEWED
SUEZ environnement	80,000	Water , Wastewater, Waste (operator of around 5000 sites, technology provider, engineering consulting)	Worldwide operations	1. Pascal Dauthuille (R&D coordinator, CIRSEE) 1. Ywann Penru (R&D project manager, CIRSEE, Wastewater Treatment & Recovery Division) 2. Sylvie Baig (Head of Scientific Innovation, former subsidiary Degrémont) 3. Delphine Antoniucci (Project engineer, Consulting and Strategy Department, former subsidiary SAFEGE)
BASF	113,200	Chemical industry	Worldwide operations	Peter Saling (Director of Sustainability Methods)
Bayer	119,400	Chemical industry	Worldwide operations	1. Laurent Dini (Sustainable Development Manager, Bayer CropScience, Environmental Science) 2. Diana Caspers (Sustainability Excellence Manager, Bayer CropScience, Sustainability & Business Stewardship) 2. Jürgen Henneböle (Global Environment and Sustainability, Bayer CropScience, Global QHSE) 3. Martin Lohrmann (Senior Sustainability Consultant, Bayer Technology Services) 3. Kianga Schmuck (Senior Sustainability Consultant, Bayer Technology

				Services) 4. Jochen Rother (Head of Environment and Sustainability Strategy, Bayer AG)
CEMEX	44,000	Construction materials	North America, South America, Europe, Asia	Alexander Röder (Green Building Manager)
Hydro	13,000	Aluminium	Global operations, main areas in Norway, Germany and Brazil	Jostein Soreide (Manager, LCA and sustainability)
Neste	5,000	Oil products, Renewable products, Oil Retail	Sales globally. Main production sites in Porvoo and Naantali (Finland), Rotterdam, Singapore	Sari Kuusisto (Associate, Research and Development) Annamari Enström (Researcher)
UPM	20,000	Forest industry (Biorefining, Energy, Paper, Plywood, Labels)	Operations in 13 countries, sales globally	Sami Lundgren (Director, Ecolabels and Reporting) Jarkko Hukkanen (Manager, Ecolabels and Reporting)

5.2 Additional methods and tools

Methods and tools mentioned during the interviews that were not in the list in deliverable D.1.1.

Table 4: Tools for sustainability assessment (short names, full names, providers, URLs)

SHORT NAME	TOOL/METHOD	PROVIDER	COMMENTS
WATERLILLY	Tool	SUEZ environnement	Tool implementing ISO conform water footprint for urban water cycles and industrial sites. It to date based on Excel and is being ported into a web-based tool (for intranets). It is used in engineering consulting, therefore not limited to the assets operated by SUEZ. This tool is in the process of being commercialised as engineering consulting.
SEAShell	Tool	SUEZ environnement	Internal LCA tool based on SimaPro with upstream (data input) and downstream (indicator presentation) interfaces to Excel. It focuses on wastewater. Used for environmental reporting of treatment plants, and to support technical tenders. It can be shared with industrial partners when SUEZ operates on industrial sites. It is a simplified LCA tool in that some indicators are selected, but data blocks are not pre-calculated: use real data in operational cases; use data specified in the contract for tenders, i.e. the data also used to calculate operational costs
AQUAENVEC	Tool	SUEZ environnement	Internal LCA tool similar to SEAShell but focused on urban water cycles. It is a web-based tool.
NOSE	Tool	SUEZ environnement	Tool for technical (sensor-based) and sensory (stakeholder-panel) auditing of olfactory nuisance. It is a software tool coupled with expertise.
PERFORM-EE	Method	SUEZ environnement	Method to assess and improve the environmental performance of an industrial facility in Water, Waste and Energy, and the facility's overall environmental footprint. PERFORM-EE involves a first broad assessment of Water, Waste and Energy aspects, followed by a more in-depth assessment of the identified hotspots, then scenario and action plans are elaborated, and the solutions implemented. Other tools such as WATERLILLY (for the water part) are used within PERFORM-EE. To date, the targets usually are large multi-site industrial clients: it addresses both site operations (internal benchmarking etc.) and the corporate sustainability strategy (incl. reporting, KPIs etc.) of the client.
LIFECARBONTOOL	Tool	SUEZ environnement	Web-based tool for registered users for measuring and reducing the carbon footprint of water treatment plants: http://www.suez-environnement.com/news/news/measuring-reducing-carbon-footprint-water-treatment-plants-www-lifecarbontool-com

Ecores	Tool	SUEZ environnement	Decision making tool built together with GDF-SUEZ. It helps to reduce the (direct) environmental impact of construction sites, in particular for water and gas pipes (e.g. finding alternative solutions to trenches). It combines environmental, social, and economic aspects. Tool targeted at both local authorities and private industrial clients.
Vivacity	Tool	SUEZ environnement	Sustainability assessment tool for urban development schemes. Assessment criteria and objectives are in part built together with the client along (direct) environmental, social, and economic impact parameters. Tool targeted at local authorities.
Mésange	Tool	SUEZ environnement	Tool for assessing and quantifying ecosystem services at a given local level. The biodiversity issue is therefore approached through ecosystem services. Tool targeted at both local authorities and private industrial clients.
CityBiose	Tool	SUEZ environnement	Tool to measure and visualise the (direct) environmental performance of key local services (water, sewerage, waste, energy systems in public buildings, street lighting and public transport). Tool targeted at local authorities.
AEU	Method	ADEME	AEU = Environmental Approach of Urbanism. Defined by the French Agency for Environment and Energy Management (ADEME), a methodological framework to integrate environmental issues in urban planning (e.g. integrate future environmental impacts through transport and heating of urban sprawl to mitigate it). Some call for tenders relevant to SUEZ environment require this method to be implemented. Some personnel at SUEZ environnement received training in this method.
HQE	Method	ASSOHQE	HQE = High Environmental Quality. A standard for green buildings in France also applied in urban planning. http://assohqe.org/hqe/
AgBalance	Method	BASF	It is a SEEBALANCE adapted to the specificities to the agricultural sector (e.g. regarding social and biodiversity aspects). Over 200 evaluation criteria are required in order to build the 69 sustainability indicators on which AgBalance is based. With AgBalance practitioners are able to holistically analyse sustainability from all of the three pillars namely, environment, society and economy.
Sustainable Solution Steering (3S)	Method	BASF	A management-based assessment method, involving life cycle thinking but not implementing LCA. It is based on workshops where product managers and technical experts are gathered and discuss sustainability aspects (based on a prepared set of questions) of the products they are responsible for with sustainability assessment experts who help them think with a life cycle approach. Through a big effort involving a long series of workshops, almost all product applications were assessed with 3S and then classified into four categories (accelerator, performer, transitioner, challenged), which brought new information on a number of products

			and now helps the company steer the development of its portfolio. The 3S approach is also a learning process for BASF employees not yet fully familiar with sustainability issues, life cycle thinking. It is part of a process called "employee engagement": every employee at BASF should have an understanding of what sustainability means and how he/she can contribute to improve BASF's and BASF's products' sustainability.
Quick scan	Tool	BASF	Internal simplified LCA tool (e.g. used in overview calculations for general assessment).
LCA flex	Tool	BASF	Internal tool more flexible than e.g. EEA in that it allows to switch between LCA models and types under certain predefined conditions.
EEA manager	Tool	BASF	Internal web-based tool that allows non-expert users to build full EEA with pre-calculated blocks or use already existing full EEAs and set parameters to run scenarios.
Social and environmental P&L	Tool	CEMEX	CEMEX has developed an internal social and environmental profit and loss accounting tool, which is currently being piloted.
BioGrace GHG calculation tool	Tool	BioGrace project	The BioGrace greenhouse gas (GHG) calculation tool has been recognised as a voluntary scheme by the European Commission. It is in line with the sustainability criteria of the Renewable Energy Directive (2009/28/EC, RED) which are equally stated in the Fuel Quality Directive (2009/30/EC). The recognition is based on RED Article 18 (4-6) and refers to proving compliance of RED Article 17 (2) and RED Annex V on GHG emission saving. When a supplier uses an approved voluntary scheme to demonstrate the sustainability of biofuels, a Member State should not require the supplier to provide further evidence of compliance with the sustainability criteria. The Excel based tool is available at the project website (http://www.biograce.net/home)
Materiality Matrix of Sustainability	Method	GRI well known– but different versions and uses exist	Guidelines for organisations on how to define the significant impacts and issues related to environmental, social and economic responsibility, and taking into account the views of the stakeholders, and the potentially significant impacts for the stakeholders.
IFC Performance standards for environmental and social responsibility	Method	International Finance Corporation (IFC)	IFC's Sustainability Framework articulates the Corporation's strategic commitment to sustainable development, and is an integral part of IFC's approach to risk management. The Performance Standards are directed towards clients, providing guidance on how to identify risks and impacts, and are designed to help avoid, mitigate, and manage risks and impacts as a way of doing business in a sustainable way, including stakeholder engagement and disclosure obligations of the client in relation to project-level activities.

			(http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/our+approach/risk+management/performance+standards/environmental+and+social+performance+standards+and+guidance+notes)
GHG Protocol	Method	WRI and WBSCD	The Greenhouse Gas Protocol (GHG Protocol) includes a set of standards and calculation tools for quantifying, managing and reporting greenhouse gas emissions. It is developed jointly by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). (http://ghgprotocol.org/)
HVO SCHEME	Method	Neste	”HVO Renewable Diesel Scheme for Verification of Compliance with the RED sustainability criteria for biofuels” is an EC recognized voluntary scheme developed by Neste. These schemes check that biofuel production did not take place on land with high biodiversity, that land with high carbon stock was not converted for biofuel production, and that the production of biofuels leads to a sufficient level of greenhouse gas emissions savings. Several schemes also take into account additional sustainability aspects such as soil, water, air protection and social criteria. http://ec.europa.eu/energy/sites/ener/files/documents/15_schemes.zip
IPIECA Global Water tool for oil and gas	Tool		The IPIECA Global Water Tool for Oil and Gas is a customized version of the free and easy-to-use World Business Council for Sustainable Development (WBCSD) Global Water Tool. The Tool will help oil and gas companies map their water use and assess risks for their overall global portfolio of sites considering each part of the oil and gas value chain. http://www.ipieca.org/topic/water/global-water-tool
Local water tool	Tool	GEMI LWT for Oil and Gas (several partners)	The Global Environmental Management Initiative (GEMI) and a group of project participant companies including IPIECA developed the GEMI Local Water Tool™ (LWT) and the GEMI LWT™ for Oil and Gas in 2012 to build on GEMI’s two existing water sustainability solution tools, Connecting the Drops (2002) and Collecting the Drops (2007). The GEMI LWT™ was developed to link to the IPIECA Global Water Tool (GWT) for Oil and Gas and provide a set of tools that companies can use to sustainably manage water in their operations. These tools are designed to be compatible to enable users to achieve full value from use of both tools. http://www.ipieca.org/topic/water/local-water-tool
WWF/DEG Water Risk Filter	Tool	DEG & WWF	Water Risk Filter can be used to assess water related risks for own operations, suppliers or growth plans. It includes indicators that cover different elements of water related risks, in different industries and in all countries of the world. http://waterriskfilter.panda.org/en/KnowledgeBase#15

5.3 Participants to the SAMT open workshop

Table 5 Participants of the SAMT open workshop on 02.06.2015 at the Wuppertal Institute for Climate, Environment and Energy, in Wuppertal, Germany

Last name	First name	Company	Job title
Alonso	Aritz	TECNALIA	Researcher and Project Manager
Dauthuille	Pascal	SUEZ environnement	Research Programme Director
Enström	Annamari	Neste Oil	Researcher
Federley	Maija	VTT	Senior scientist
Haasen	Christopher	Schlange & Co.	Consultant
Jenke	Martin	CEMEX	Advisor Novel Technologies
Kraemer	Alexander	AfB social & green IT	CSR/ Development Manager
Laget	Staf	Umicore	Leader Climate, Recycling and Product Sustainability
Lohrmann	Martin	Bayer Technology Services GmbH	Sustainability Consulting
Manent	Aurelie	Evonik Industries	Life Cycle Analyst
Pajula	Tiina	VTT	Principal scientist
Penru	Ywann	SUEZ environnement	R&D Project Manager
Pihkola	Hanna	VTT	Research Scientist
Ritthoff	Michael	Wuppertal Institut	Project Co-ordinator
Röder	Alexander	CEMEX	Green Building Manager
Saling	Peter	BASF SE	Director Sustainability Methods
Saurat	Mathieu	Wuppertal Institute for climate, environment and energy	Research fellow
Sauvion	Guy-Noel	SOLVAY	Fellow Scientist - R&I projects evaluations

Smith	Luz	AENOR	Head of Industry&Equipment Standardization Direction
Wedel	Amy	Heidelberg Cement	Sustainable Construction Manager
Wranne	Jonatan	IVL Swedish Environmental Research Institute	Researcher

5.4 Interview guidelines

Introduction

The aim of the SAMT project is to review and make recommendations about the most potential methods for evaluating sustainability in the process industry. SAMT is a coordination and support action that promotes the cross-sectorial uptake of the most promising methods and tools by conducting case studies, organizing workshops and producing recommendations for further implementation of the best practices in sustainability assessment.

The aim of the interviews is to collect the experiences of industrial actors and to learn from industrial partners how and why they use (or do not use) certain methods and tools for sustainability assessment. An important aspect is the ability of the methods and tools to support decision-making in different contexts. In addition, future research and development needs will be discussed. Based on the interviews, an understanding of best practices in different industrial sectors will be built. The outcome of the interviews will be applied in the work of WP2 in evaluating and testing the assessment methods, and for mapping the future development needs and recommendations in WP3.

In the context of the SAMT project, we use the following definitions:

- **Method:** set of instructions describing how to calculate a set of indicators. Methods include official standards.
- **Tool:** artefact that assists with the implementation of a method. A tool is usually software but it could also be, for example, a paper-based check-list.

Those definitions are by no means “official” but the ones we use in this project to avoid confusion. These terms are indeed used differently by many stakeholders in the scientific community, in policy, in the industry etc.

The guidelines include a rather long list of questions to cover relevant aspects discussed during the project. Please note that all questions might not be relevant to all companies and the irrelevant ones can be ignored during the interview. Please ask for clarification, if any of the questions seems unclear to you.

With the permission of the interviewed person, the interviews will be recorded. After the interview, the interviewer will send a written memo for approval to the persons in question. The written memo will be used as research material in the project.

Interview questions

1. **General information**

- Name of the company:
- Number of employees (total, at the site):
- Independent company or affiliated?
- SME (<250 employees, =< 50 Mio. Turnover): yes – no
- Sector/sectors:

- Geographic areas in which the company operates:
- Name of the person interviewed:
- Function in the company:

2. Purpose of sustainability assessment at the company

2.1. When did your company start to work with sustainability assessments (or some kind of version of sustainability assessment)?

2.2. How is sustainability assessment applied in your company at the moment?

2.3. In what kind of situations are assessments conducted or is the information applied? For example marketing, communication, R&D, investment decisions, choosing suppliers or something else? Please give examples from your company.

2.4. What is the typical scope of the assessment? (own products, sites, technologies, including suppliers or customers…?)

2.5. Is the use of sustainability assessment mandatory or optional? How is it decided when an assessment is to be conducted or not?

3. Who is working with sustainability assessment at the company

3.1. How is the work related to sustainability assessment organized? (For example, do you have your own department for sustainability issues or are there specialists working in different parts of the company, or do you work with external consultants?)

3.2. How many persons work with sustainability assessments in your company?

3.3. Who applies the results? (For example business sectors, top-managers, designers, marketing…?)

4. Sustainability assessment methods and tools applied

Methods

4.1. Which sustainability assessment method(s) are applied at your company? [can use method list from D.1.1 as a help]

4.2. On which aspects of sustainability do you focus?

- Environmental indicators (which ones?)
- Social indicators (which ones?)
- Economic indicators (which ones?)

4.3. Which outputs from sustainability assessment method(s) do you mainly use?

4.4. What kind of advantages or disadvantages relate to the methods you apply?

4.5. Does your company use its own methods? [i.e. not publicly available] yes – no

- If yes, is some description available in the literature, on the Web?
- How was the method developed? (in-house development, contractors etc.)
- Reasons for developing your own method?

Tools

4.6. Does your company use publicly available tools for the assessment (commercial and/or free)? yes – no

4.7. Which tools? [can use tool list from D.1.1 as a help]

4.8. Does your company use its own tools? [i.e. not publicly available] yes – no

- If yes, is some description available in the literature, on the Web?
- How was the tool developed? (in-house development, contractors etc.)
- Reasons for developing your own tool?
- Main features of the tool? (methods, output formats etc.)
- Information system required?
- Competences required for using the tool?
- Plans to make the tool publicly available? (commercially or not)

4.9. What kind of advantages or disadvantages relate to the tools you apply?

Data

4.10. For the methods and tools cited above, do you use:

- Commercial or public databases? Which ones?
- Company internal data? (give examples from your company)
- Data from your suppliers?

4.11. Regarding internal data and data from suppliers, how is data collection organised?

5. Experience and expectations from using sustainability assessment at the company

5.1. Regarding the practice of sustainability assessment in your company, what works well in your organization and what would you recommend for others?

5.2. What is the biggest challenge or development need related to sustainability assessment in your company?

5.3. Are you interested to hear/learn from experiences in other companies?

- If yes, what would you like to know?

5.4. Regarding methods and tools you are using, are they sufficient for your requirements?

5.5. Do methods or tools that you use need extensions?

- If yes: which extensions, for which applications / business sectors in the company?

5.6. Is your company planning on implementing additional methods or tools? Which ones?

5.7. Do you think new methods are needed?

- If yes, for which applications / business sectors in the company?
- Requirements for the method (scope, indicators etc.)
- Which type of method? [see clusters in D.1.1—e.g. integrated, hybrid methods etc.—for a help]

5.8. Do you think new tools are needed? (For existing methods or methods to be developed)

- For which applications / business sectors in the company?
- Requirements for the tool (method, output, competence required, free etc.)

6. Standardization

6.1. Some sustainability assessment methods are up to a certain degree standardized.

- Which standards related to sustainability assessments do you use? [see review of standards in WP1 for a help]
- Is the level of standardization of the method(s) that you use sufficient?
- Is a higher level of standardization required?
- Why do you choose or refuse standardized methods?
- …

7. Feedback on review of methods and tools in D.1.1

7.1. Can the D.1.1 method and tool lists (with literature a web references) be useful to you?

- In which cases? For whom in the company?

7.2. Can the D.1.1 reviews of methods and tools and the visualisations of their linkages be useful to you?

- In which cases? For whom in the company?

7.3. Which other aspects / parameters would you like to see considered in the reviews / visualisations?

7.4. Do you feel that the method and tool lists in D.1.1 are:

- complete?

- missing relevant methods or tools?
- …?

8. Feedback and expectations related to the SAMT project

8.1. What kind of expectations do you have for the project (for example workshops, case studies, final outcome)?

8.2. Cross-sectorial sustainability assessment is one of the focus areas of the project. Do you think cross-sectorial assessments would be useful to your company? If yes, in what way?

8.3. What is your feeling about the project after the first 5-6 months?

Thank you very much for your input!