# The international ecosystem for accelerating the transition to Safe-and-Sustainable-by-design materials, products and processes.

## Update: Skills, knowledge and education needs and gaps and mismatches for the uptake of SSbD

*Lutz Walter, Tilla Kross*

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## Disclaimer



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## Abbreviations and Acronyms

| Abbreviation | Definition |
|---|---|
| CE | Circular Economy |
| CEFIC | The European Chemical Industry Council |
| CRMA | Critical Raw Materials Act |
| CSR | Corporate social responsibility |
| CSRD | Corporate Sustainability Reporting Directive |
| DFE | Design for Environment |
| DPP | Digital Product Passport |
| EC | European Commission |
| EHS | Environment, health and safety |
| EHS/S | Environment, health and safety and sustainability |
| EoL | End-of-Life |
| ESG | Environmental, social, and corporate governance |
| ESPR | Ecodesign for Sustainable Product Regulation |
| EU | The European Union |
| GHG | Greenhouse gases |
| HR | Human Resources |
| HSE | Health, Safety, Environment |
| IMDS | International Material Data System |
| LCA | Lifecycle Assessment |
| LCC | Life cycle cost |
| OEM | Original Equipment Manufacturer |
| PNL | Profit and loss |

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| | |
|---|---|
| PPA | Power Purchase Agreement |
| QHSE | Quality, Health, Safety, Environment |
| REACH | Regulation on the Registration, Evaluation, Authorization, and Restriction of Chemicals |
| R&D | Research and Development |
| R&I | Research and Innovation |
| SBTi | Science-based Targets initiative |
| SLCA | Social lifecycle assessment |
| SME | Small and Medium Enterprise |
| SoC | Substances of Concern |
| SPM | Sustainable Portfolio Management |
| SSbD | Safe-and-Sustainable-by-Design |
| TRL | Technology readiness level |
| US | The United States of America |
| VC | Value chain |

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# 1 Executive summary

Based on the interviews with company representatives of five value chains, this Deliverable provides insights into how well-known the SSbD concept is amongst companies of the different value chains engaged by the IRISS project, how they manage safety and sustainability in their innovation processes and most specifically which skills, knowledge and education needs and gaps and mismatches exist that may prevent the uptake of the SSbD concept.

Like in the first stage, Deliverable 4.4, we identified a clear distinction between safety and sustainability, in terms of how well established these concepts are in the seven value chains studies and how much knowledge and practical implementation skills professionals have about them.

The company interviews confirmed that safety clearly is well established and an integral part of the processes in these industries. The dominant focus of safety, however, largely varies between value chains and production stages (worker safety, user safety, environmental safety, etc.).

Sustainability, on the other hand, is a more recent concept, which is much less established or integrated. Most companies have some form of sustainability strategy in place, which differ in their focus and degree of implementation. Several interviewees highlighted uncertainty in terms of definition of sustainability also impacted by a rapidly changing regulatory framework for sustainability across different sectors. For the time being, regulatory compliance and emerging market demand for more sustainable and circularity solutions are the major drivers of sustainability efforts.

As the SSbD Framework should be applied to early-stage innovation, how innovation processes are organised internally and who is involved in it came up frequently. All companies bring together different departments, experts and sometimes their suppliers and/or customers to collaborate in the development of new materials/products/processes.

Functions within companies which would need (thorough) SSbD knowledge vary depending on the sector and can be found in different departments based on the organisational structure and the size of companies in the value chain. Whereas a few of the interviewees were aware of the SSbD Framework, the majority said that it was not widely known in their sector.

Existing training practices and needs on safety and/or sustainability were identified. As a general rule, larger companies and those where strict safety rules have been in application for a long time, have well-established internal and sometimes externally supported training practices for safety procedures and practices. Smaller companies rely more heavily on information and training provided by suppliers of chemicals, materials and processing technologies or specialised external training providers. For sustainability, skills acquisition is less formalised both in terms of subjects and delivery and in addition to regulation also heavily dependent on individual company strategies or market-driven demand for sustainable products and services.

It is observed that European universities put a stronger emphasis on sustainability education and include it increasingly in their curricula.

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# 2 Introduction

Following Deliverable 4.4 about the uptake of the SSbD approach by the value chains, that mapped the SSbD training and knowledge gaps and needs in the value chains according to industry associations, this Deliverable 4.10 will examine the same issue in more detail from companies point of views. The outcome of this Deliverable will feed into Task 2.5 to identify the value chain specific skill gaps, mismatches and the potential interactions needed within and across value chains to overcome those.

This Deliverable provides insights into how well known the SSbD concept is amongst companies, how they exercise safety and sustainability as well as the knowledge and training gaps of the SSbD concept.

The interviewed value chains were as follows:

- Automotive (represented by a global supplier of technology and services)
- Electronics (represented by a multinational corporation and technology company/an international roadmap organisation)
- Energy materials (represented by a global leader in innovative products based on science and chemistry, and a multinational materials technology company)
- Packaging (represented by a global supplier of food packaging solutions, and a leading supplier of circular food packaging)
- Textiles (represented a SME of textile production, and the global leader for technical textiles and protective clothing)
- *Fragrances (the views of individual companies were already included in D4.4)*
- *Construction chemicals (no interview partner found)*

We tried to address the next steps as identified in D4.4. However, it was difficult to find sufficient interview partners. The ones we found were mostly interviewees representing large companies and only two SMEs.

We received input from a variety of positions, some of which have been identified in D4.4 as functions in (high) need of SSbD knowledge, including sustainability experts and R&D experts. All experts interviewed were able to provide insights into how their company approaches SSbD-related topics across different departments. We succeeded in identifying current training techniques and providers in each of the five value chains as well as functions/departments/roles with specific knowledge gaps & needs, who are likely the most involved in SSbD-related processes and therefore are most in need of SSbD-related expertise, tools, and training provisions.

Finally, we inquired how training for SSbD-specific skills is organised and what type of internal and external competence/training providers are involved or would be needed, if not readily available. We also asked about the interviewees' perception of the SSbD-related knowledge of recent university graduates.

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# 3 Methodology

Task 4.4 has been completed in two stages, resulting in the current Deliverable (D4.10) in month 20, following a first Deliverable (D4.4) in month 10.

In this second stage, interviews have been conducted with one or two companies from each value chain for a more profound understanding and experience-based information regarding the training gaps & needs. First, we identified the interviewee's function inside the company and aimed to understand the company's core business. Second, we inquired about existing SSbD knowledge. Third, we discussed where SSbD-related skills and knowledge already exists and are located inside the company. Fourth, we asked about existing and missing education and training programmes.

To complete D4.10, the following steps have been taken:

- Update of the questionnaire used for Deliverable D4.4 – to prepare for structured interviews across all value chains (Annex II)
- The value chain representatives inside the IRISS project were asked to suggest interview partners and they established a first contact, which was followed-up by ETP with more details
- Eight individual online interviews conducted with companies representing five value chains (duration: 1 hour each) between October 2023 and January 2024 (Annex I)

Individual companies from the fragrances sector were already involved in the first round of interviews in stage 1 and their views were incorporated in D4.4.

For the construction chemicals value chain five different companies suggested by the consortium were contacted, but there was no company representative willing to be interviewed found.

Throughout this Deliverable we refer to the JRC's *Safe and sustainable by design chemicals and materials – Framework for the definition of criteria and evaluation procedure for chemicals and materials* (2022) as the "SSbD Framework".[1]

[1] Caldeira, C., Farcal, R., Garmendia Aguirre, I., Mancini, L., Tosches, D., Amelio, A., Rasmussen, K., Rauscher, H., Riego Sintes, J. and Sala, S., Safe and sustainable by design chemicals and materials - Framework for the definition of criteria and evaluation procedure for chemicals and materials, Publications Office of the European Union, Luxembourg, 2022.

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# 4 Findings per value chain

## 4.1 Automotive sector

**Interview partner (person & company)**

The interview partner for the automotive sector was a senior expert and coordinator for design-for-environment in research and innovation (R&I), with a background in chemistry/materials science and >15 years job experience. In the current role, the interview partner focusses on circular economy (CE), including early-stage innovation for CE and (raw) material risk management.

The company is a multinational automotive supplier company with >200 000 associates and >50 000 researchers and developers worldwide.

**SSbD relevance at the company level and level of knowledge**

The interview partner understands the relevance of SSbD as a Design thinking guidance for hazard assessment and (re)-design considerations to be applied in an early development phase while considering the whole life cycle. It is seen as part of the EU chemicals strategy for sustainability but should also apply to processes and products along the value chain for different industry sectors. The interview partner understands the overarching goal of SSbD to achieve more safe and sustainable products for society, targeting goals for climate neutrality, zero-pollution and non-toxic environment, circular economy, and societal responsibility. The SSbD approach should help getting better prepared for upcoming regulatory challenges like the Corporate Sustainability Reporting Directive (CSRD), Critical Raw Materials Act (CRMA), Ecodesign for Sustainable Product Regulation (ESPR) or digital product passport (DPP).

SSbD may first be linked to the chemical and material industry. It means that “SSbD” as a wording and framework is still not explicitly known or adopted as such within the company. The knowledge about the SSbD framework within the organization and among associates is at the current time limited or mostly inexistant.

There may be moreover a different understanding about the meaning of “Safe” in SSbD between the chemical industry and the automotive industry that should be addressed to prevent misunderstanding. In the automotive industry, “safety” concept must consider use and exposure risks and should consider the whole product life cycle in all its different potential applications.

When talking about “a product”, the definition may also differ depending on the position of the company in the automotive supply chain (material supplier, Tier n, Original Equipment Manufacturer (OEM), machinery and equipment manufacturer). It means, according to the interview partner, that the understanding about SSbD may also differ if we consider the end product as seen by the end user, or if we consider systems, sub-systems, components and sub-components, or even material levels.

By taking an example, in the automotive industry, the materials selection at company levels follows legal requirements (e.g. for substances of concern (SoC) and safety requirements),

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OEMs´ requirements but also has to consider availability and reliability aspects or increasingly sustainability considerations like material carbon footprint or material criticality.

When having a look at the broad of the SSbD framework and its different elements and trying to match this with the existing sustainability strategy, objectives, and practices at the corporate and product level, then the company is already dealing with some aspects of the framework - without talking explicitly about SSbD. Following activities are given as an example (not exhausted list):

- Management and restriction of use of SoC, material declaration, use of automotive International Material Data System (IMDS), early warning risk management for SoC
- Code of business conduct for associates and business partners considering legal, safety and environmental protection as guideline
- Scope 1, 2, 3 objectives
- Use of Design-for-Environment and Eco-Design guidelines (Rs principles) for product developers, engineering, and design teams
- Calculation of material and product carbon footprint (MCF, PCF), calculation guidelines, lifecycle assessments (LCAs)

It is a necessity to develop and manage knowledge and new skills within the company to support and enable this development. This is done e.g. by supporting lifelong learning for associates with dedicated trainings in form of internal web-based trainings, face-to-face training in peer groups, blended learning, exchange in internal and external expert networks, hiring new associates with dedicated skills (e.g. LCAs, Eco-design, sustainability), cooperation with academics by offering master or PhD thesis, R&I activities with relevance or participation in funded projects.

**Functions in need of thorough SSbD knowledge**

Following functions should get SSbD knowledge and skills in an appropriate way within the company:

- Product developers, engineering, and design teams
- Product managers
- LCA & life cycle costing (LCC) experts
- Experts for Design for Environment (DFE), eco-design and sustainability, safety and quality
- Supply chain management, purchasing
- Marketing and sales / customer relations
- Regulatory compliance and legal affairs
- Organisational sustainability officer

Relevant external stakeholders should also get knowledge about SSbD

- Partners over the value chain (upstream / downstream) (e.g. suppliers, OEMs)
- Academics and research institutes, young professionals
- Industry associations, standards organisation
- Investors and financial institutions

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The interview partner sees a strong need to increase **awareness and common understanding** about SSbD within the automotive industry and along the automotive value chain. At this point in time, it remains unclear how the entire SSbD framework should be addressed or implemented in the automotive industry, and where to apply it along the automotive value chain.

The conceptualization to enable the implementation of SSbD-aspects needs **extensive knowledge about SSbD and lifecycle considerations**. Data gaps and uncertainties in early development phase, lack of harmonization and standards are seen as a challenge too. There is almost no experience considering social-LCA assessment within the company. Developers within the company face a lack of high-quality data for LCA and LCC along the supply chains. Circularity and end-of-life (EoL) management encompass newer aspects and are difficult to measure. It makes the **impact assessment and decision-making** challenging.

It is also unclear how to deal with potential trade-offs, e.g.: material and substances that enable higher durability of automotive parts may not be an optimum for recyclability, life cycle emissions, cost requirements, or natural availability. How to assess the optimum?

The automotive industry is experiencing rapid technological advancements, including electrification of propulsion, automated driving and connectivity. Keeping pace with these advancements and understanding the implications for SSbD requires research and learning.

The SSbD framework requires collaboration and coordination across various functions within an organization. **Skills for cross-disciplinary collaboration and fostering a culture of continuous improvement and learning** are a necessity.

SSbD considerations extend beyond the boundaries of individual companies to encompass the entire automotive supply chain. Skills and ability to deal with supply chain integration and complexity, inclusive data availability, transparency and performance metrics are of high relevance for the uptake of SSbD.

There is currently a lack of formal education and training programs focused on SSbD principles and methodologies for the automotive industry. Providing real-world case studies and practical examples illustrating the application of SSbD principles in automotive design and development, allowing employees to learn from concrete experiences and best practices should be also a target.

**<u>Training gaps & needs</u>**

From an industry perspective, it is of high relevance to improve skills on SSbD and to provide stakeholder targeted education & training for students / young professionals, for associates in the context of lifelong learning, and for business partners along the supply chain, including SMEs.

In the context of the company, three levers of education / training are needed:

1) to improve SSbD awareness and common understanding.: to enable different functions and actors to work together and achieve commitment for SSbD and life cycle thinking
2) extensive / specific knowledge training for SSbD: functions or experts specific, e.g. LCAs, SLCA, LCC, safety assessment, circular economy indicators / CE business models, Eco-design rules, tools and data, simulation, etc…

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3) SSbD Impact assessment and decision making, how can SSbD brings benefits in practice, how to measure and steer impact.

Training / education programs should foster interdisciplinarity and strengthen collaboration and information between actors. Modern, digital, and accessible learning possibilities like tutorials, web-based trainings, training in peer groups, blended learning, exchange in expert networks, data platforms, work on use cases should help the uptake of SSbD.

## 4.2 Electronics sector

**Interview partner (person & company)**

The interview partner for the electronics sector was working at a multinational corporation and technology company for 18 years as an environmental process engineering manager, materials technologist, as well as in sustainability and smart infrastructure areas in the semiconductor manufacturing and technology development.[2] The company is one of the world's largest semiconductor chip manufacturers. Today, he leads a global roadmap organisation of the industry, defining the Environmental, Safety, Health & Sustainability long range risks and challenges. He has a background in physical inorganic chemistry and is based in the USA.

As it is very difficult to get formal statements from current employees at major semiconductor companies, the interviewee was questioned about his previous role and his general view on the semiconductor industry, from a technology roadmap perspective. That said, the comments reflect his personal perspective, and he is not speaking on behalf of the roadmap or the other companies with which he has worked in the past.

**SSbD relevance in the semiconductor industry**

The interviewee sees the SSbD Framework as a useful tool for the industry to consider safety and sustainability concerns, especially at the technology development stage. It is much more time efficient and cost-effective long term, to make technical product/process/tool decisions to address emerging technical issues upstream to mitigate risk by considering relevant Environment, Health, Safety and Sustainability (EHS/S) criteria and implications ahead of electronics and device manufacturers, than downstream in the technology life cycle, when it's much more costly to address issues reactively.

**The approach on safety and sustainability in the semiconductor industry**

Within the semiconductor industry, how EHS/S issues can be managed at a corporate level depends on the specific corporate culture and organization. For EHS/S, regulations, permit and local requirements are all drivers, depending on their local circumstances and type of technologies manufactured.

One of the typical challenges for effective implementation of SSbD is that EHS/S issues can be managed differently, either at a local site level, or by a centralized corporate group. Sometimes the manufacturers in the supply chain take care of the local materials or

[2] Microsoft Teams online interview, Lutz Walter (Textile ETP) and electronics value chain representative (a multinational cooperation and technology company/international roadmap organisation), duration: 60 minutes, date: 18 December 2023.

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equipment regulations. A semiconductor company has different sites, located in different regions/countries and thus subject to different regulations for, i.e., wastewater, air emissions, fire safety. The plethora of different regulations and their lack of uniformity across the world makes it challenging for global semiconductor companies to deal with. Therefore, the interviewee sees an ongoing need for global standards of SSbD topics (metrics, KPIs etc), as well as the necessity for pre-competitive systems, such as national research centres, technology roadmaps and particularly sponsored research and development focusing on Environmental, Health and Sustainability emerging challenges.

By contrast in the area of safety, this field has become fairly mature, with broadly agreed metrics, protocols, and processes for managing and maintain safe work environments over the past decades. Despite the use of a broad range of chemicals, some of which are toxic, flammable, pyrophoric and or hazardous, common usage of high voltage/power in process tools, etc., today's semiconductor factories have generally become very safe environment workplaces.

Concerning sustainability, an integrated view on product side for the semiconductor chip's production and lifetime is essential for evaluations such as a life cycle analysis, total energy consumption, carbon footprint, ect.: It depends whether one looks at the computer, its whole lifetime and how much energy it saves in contrast to how much energy is required for its production (clearly defining the scope of the evaluation up front). From a corporate perspective, the Sustainability section can be a distinct and separate entity, often, separate from technology/R&D divisions. In such a case, this can result in a more reactive response to sustainability challenges, rather than being a parallel development activity to the process development itself. The interviewee sees the need to embed SSbD thinking in the R&D department and create a connection between the two, through a specific process that establishes an ongoing interaction between these two groups.

To illustrate the complexity and challenges of the environmental considerations, he shares, amongst others, this example: It is important for semiconductor companies that they bring together materials, their properties, the tool, and the actual technology process, to internally evaluate the real impact of the material in terms of their emissions. This is done in parallel with research development, by modelling the process and doing chemical measurement validation of the emissions. It can happen that a material has adverse environmental properties, but in a real-world example, it was found that the material completely broke down in the process equipment tool and was very easy to treat. This would not have been understood by looking at the materials properties themselves, but was evident by also evaluating the specific process and the actual semiconductor equipment tool used.

**The innovation process in the semiconductor industry**

The development of a new process, tool or material is a complex challenge for the semiconductor industry. Nowadays, large companies tend to focus more on either internal research, in collaboration with specific sponsored research with key institutions and research consortia, or in joint projects with suppliers. Typically, a semiconductor company has an integrated supply chain organisation that cuts across all the manufacturing and development that manages the suppliers, who are involved in the innovation process, which include both direct and indirect suppliers. One key change, has been the integration of environmental, sustainability, social responsibility and governance elements into the supply

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chain organization, which work with suppliers to set expectations for their performance in these areas, provide technical information on tools and processes to help them, and have integrated key objectives and yearly performance goals as part of their overall supplier grading on a year-to-year basis, thus proactively driving ESH/S upstream.

Building a factory, developing a new process, tool, or material is a long process. For the development of semiconductors, materials suppliers, equipment suppliers and development factories are involved. Usually, when a new process, tool or material is being developed a group of technologists evaluate EHS/S impacts real time, in parallel with technology process and product development (typically high-level chemists, chemical and environmental engineers who work in concert with their R&D peers).

According to the interviewee, there are two key factors in the innovation process that are required for designing out EHS/S emerging issues early on: comprehensively assessing the risks associated with innovation proactively, mitigation and having a robust process to communicate and to modify the R&D process at the time, to ensure improve technical decision making. The more information the companies have up front, the better they can think about the implications of the technical decisions in the context of key EHS/S criteria. This can only be done, by having a dedicated group or organization which is part of both the R&D organizations, which is directly linked to senior executive management, to ensure that a strategic, technical, long term and technical approach is prioritized, and not driven by short term operations management.

**Functions within the semiconductor industry in need of thorough SSbD knowledge**

- Executive level
- R&D organization
- Technology development organization
- Supply chain organization (including materials and equipment groups, both direct and indirect, logistics, warehouse, etc.)
- Manufacturing organization (this extends to semiconductor process, packaging/assembly test/product groups)
- CSR and EHS groups
- Business units (incl. finance)
- Training and document control departments (this is key, in terms of setting clear expectations, processes and systems to implement and standardize how these elements fit into their work)

To address the environmental, social and economic dimensions of sustainability, working together with the suppliers is vital. It is helpful to have a supplier apply or integrate a key tool, system or process about assessing what the nature of the material will be and whether there are any EHS/S issues. These collaborations also extend downstream to customers (they have their own requirements and specs as well), and with the investor communities.

**Trainings gaps & needs**

In the US, universities and colleges voiced their support for the CHIPS and Science Act (2022) that supports expanding the semiconductor manufacturing capacity and development capacity of semiconductors, electronics, and packaging in the US. As of now, a disproportionate amount of manufacturing capacities are located in Asia, though there continues to be significant R&D and manufacturing presence in the US and Europe. This

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imbalance should be addressed with the CHIPS Acts, both in Europe and the US. It also aims to address the workforce development and education. People with skills in the right places are needed for the industry in the US to survive, though with the unprecedented growth in manufacturing, this is a global problem.

In Europe, the organisation between research consortia, universities and manufacturers is seen as robust. The interviewee sees a high-level focus on sustainability in Europe, and in Japan. Additionally, environmental development is particularly sophisticated and forward looking in Taiwan as well.

## 4.3 Energy materials sector

### 4.3.1 Energy materials sector - interview 1

**Interview partner (person & company)**

The interview partner for the energy materials sector works for a global leader in innovative products based on science and chemistry as Deputy Chief Sustainability Officer.[3] He has since moved to the position of head of partnerships in the corporate sustainability team. He has 15 years of experience working with sustainability at the company and represents it in the Sustainability Forum of CEFIC.

**SSbD relevance at the chemical producer**

Around 15 years ago the company started the quest of realising sustainability with an economic impact for the company. They came to the conclusion that SSbD is beneficial, if used the right way. Back then the interviewee received the mandate to develop a system/tool in order to meet the expectation of the SSbD Framework and evaluate its impact from a profit and loss (PNL) perspective. This tool is now called Sustainable Portfolio Management (SPM) tool and available online. Its main intention is for portfolio management decision purposes.

The SPM tool can be considered the company's workable response to the academic SSbD Framework that would require a large amount of data at the early stage of the innovation process, which is seen as unworkable for any industry.

**The approach on safety and sustainability at the chemical producer**

For the interviewee, the main objective is to bring sustainability at the same level as safety, not one after the other. To him, it is clear what needs to be done on the environmental sustainability side, e.g. CO2 reductions and combatting deforestation, the social sustainability side however is less advanced. He sees the need to discuss how to define sustainability for their sector.

Concerning safety, there are priority one substances, priority two substances, and guidelines on how to treat them. He emphasizes that "functionality is not a permission to do whatever

[3] Microsoft Teams online interview, Lutz Walter (Textile ETP) and energy materials value chain representative 1 (a global leader in innovative products based on science and chemistry), duration: 60 minutes, date: 9 November 2023.

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you think is good". The product's functionality ultimately will depend on where it is going, e.g. red-carpet dress or fire fighter protection.

At the company safety and sustainability is discussed specifically when a new project or product is being developed using their SPM tool. The aim is to achieve a performance and price level that matches safety, sustainability and economic requirements. For sustainability they look mostly at the carbon footprint, but also the environmental footprint. The company works towards a circular economy by improving their materials and designing products differently to enable dis- and reassembly so they can be re-accessed later. It looks at the EoL of a product from the consumer perspective and follows it back up to evaluate what that means for the material going into functionality. He says that not taking into consideration what is coming from a safety and sustainability perspective would be a risk. The company is involved in recycling of batteries, electric vehicle batteries and magnets. Recycling is not a huge business, but they are involved to work together with their customers. Most change can be achieved with the product design.

According to the interviewee, sustainability in the chemical industry is not mainstream enough, but it is significant. At the company, they set an objective on the revenue being made part of the solution, not the problem (by 2030 65% of their revenue should be future proof). To ensure the investments are reasonable, they use their SPM system/tool to evaluate the PNL of sustainability, followed by internal and external audits on their findings. In their view, safety is part of sustainability. In a circular economy all sustained ESG elements are part of that.

**The innovation process at the chemical producer**

The SPM system/tool is embedded in the decision-making process, including on innovation. The company assesses sustainability at innovation project level. For the company it is important that sustainability is implemented in all causes of the company. People in the innovation & research department are working together with customers on innovation projects. They need to generate the necessary information and data for that process to evaluate whether also sustainability goal targets are being met. For that evaluation someone from the sustainability team, from the business unit and several people from the innovation project come together depending on the complexity of the innovation project. They discuss fact-based sustainability targets and customer targets together. Their customers want to create new solutions and they have an interest in showing that these solutions are more sustainable because it allows them to save materials, energy etc.

With some customers they engage in conversations on total cost of ownership at their end, which means that they would evaluate the economic benefit, the reduction in environmental costs for the society and the social costs.

At the company, innovation does not allow compromise. The innovation has to match technical requirements and economic requirements. Sustainability comes on top and is not a compromise on profitability. It does not develop a more sustainable product when they could not reach a compromise with their customer. As any company they have limited resources for innovation so they prioritize allocation of resources to that project that is part of the solution, meaning which will be more profitable and has a lower impact. Innovation projects have to be both profitable and sustainable.

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**Examples from the energy materials sector**

Photovoltaics is one of the end markets of the company. At safety level there are component and material perspective, but also use dismantling and recycling perspective. The interviewee sees more conversations taking place about the EoL of the materials of a solar panel or wind turbine and how can they be designed differently to include safety and sustainability and enable material re-access.

Car batteries of electrical vehicles are another example of a product where at one point the critical materials inside the batteries like cobalt need to be re-accessed. The safety aspect for batteries is mostly where they are going at the EoL. There exist new business models like car companies keeping the ownership of the batteries. However, for the car itself it is more difficult for the car company to re-access its materials at the EoL because it is difficult to keep track of its lifecycles.

**Functions within the chemical producer in need of thorough SSbD knowledge**

- Sustainability experts
- Project innovation directors

According to the interviewee, SSbD is a topic for experts and only dealt with by those inside the company. Nevertheless, there is the need for a system to be in place for all the employees to understand what it is about. Project innovation directors or experts in a project need to have a more thorough understanding of SSbD then the marketing team or sales representatives.

**Trainings gaps & needs**

- General understanding for the whole company
- Sales representatives
- Providing knowledge for their customers

The different needs for SSbD education need to be mapped and a system for each role/department to understand what it is about needs to be found.

At the company, when a sales representative shows a new product to a client, he/she will have to discuss the safety data sheet and its content. They need to be comfortable to discuss it with customers, including possibly experts or smaller company experts. The company's customers need to have at least the minimum knowledge on the performance, the safety and sustainability aspects of the product. It is responsible to provide knowledge on safe usage, tailored to the value chain it is serving up to the end user.

The company's sales representatives need to know the product, its functionality and sustainability features. Thus, they need to have an understanding of SSbD to flag the voice of the company when it comes to safety and sustainability. They have to undertake and succeed in sustainability tests. This has been defined in cooperation with the human resources (HR) department that is responsible for education. To a certain extent, they have a training function for the customer because they often teach the customer depending on the product. For sustainability the company discusses with its customers, for example, how the use of a material/chemical can be more sustainable, how they can ensure to not waste it, how to ensure high output quality, and whether a change of processing conditions can lead to less energy usage and is thus profitable on the economic side too. For safety, the

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company has the legal obligation to ensure safe usage of their products, so they train their customers and audit them and their installations to ensure safe usage of the product.

Concerning training development, it depends. For sustainability, the company develops sustainability training in-house, tailored to their needs. Some of the systems they use to measure it are not mainstream, which makes it difficult to find specialised consultants on this. For human rights due diligence in supply chains they work with consultancies as there is a great availability of them.

Especially smaller companies rely on their suppliers like the company to teach them how to use the materials or chemicals safely. This requires internal mapping of training needs.

### 4.3.2 Energy materials sector – interview 2

**Interview partner (person & company)**

A second interview for the energy materials value chain was conducted with a representative of a multinational materials technology company headquartered in Europe.[4] The representative and the company prefer to remain anonymous. The company is specialised in refining and recycling precious metals and the manufacture of specialised products from speciality metals. The interviewee is a chemist with over 25 years of experience in working with metals and technologies. The interviewee works in a central department responsible for advocacy and public funding.

**SSbD relevance at a materials technology company**

The company first got to know the SSbD Framework via the Association of the Chemical Industry Germany (VCI). The company is sceptical about the current design of the SSbD Framework and has already voiced their concerns to the German government in a public hearing and in a statement submitted for the EU consultation. At the moment, it is unclear what the consequences of SSbD are, whether it will be considered a label or a regulation in the future and whether it will cause disadvantages in cases of access to R&D funding.

Speaking for the awareness in the industry, the interviewee sees rising awareness of SSbD and its potential threat amongst their customers. They heard about the SSbD Framework in public hearings by the European Commission (EC) and workshops organised by the chemical industry. The Framework is not seen as an easy-to-use tool but rather a roadblock, which leads companies to reconsider engaging in R&D work in a certain sector. Many companies are concerned that it is too bureaucratic, too complicated, a heavy workload, and restrictive.

In general, the interviewee is in support of having a framework to support sustainability decision making, possibly more in the form of LCAs. Safety issues are already well defined and managed. The issue with the current SSbD Framework is that its strict step-by-step procedure with cut-off criteria especially in the first step “Hazard” leads to unbalanced categories.

[4] Microsoft Teams online interview, Lutz Walter (Textile ETP) and energy materials representative 2 (a multinational materials technology company headquartered in Europe), duration: 60 minutes, date: 28 November 2023.

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**The approach on safety and sustainability at a materials technology company**

The interviewed company is at the early stage of the value chain and has access to information of the material. For the analysis of the different materials, not only the data but also the experts from the company's specialised EHS department are needed. To ensure safe handling of the material, safety data sheets and some additional information are passed on to the next partner in the value chain. It can be expected that going forward with SSbD means that organisations in a later stage of the value chain will need access to more information than today from materials producers, which will be work intensive. To ensure a safe work environment, the company has a very active EHS department. Their products are typically handled in closed systems and in line with standards considered safe by the EU.

The interviewee stresses the importance of taking the overall social economic balance of a product into account. For example, nickel is a harmful metal that is crucial for the production of high-performance batteries, which save a lot of energy in the use phase of an electric vehicle. At the EoL, the metal can be recycled and put back into the circle. However, there are also materials one would not recycle as there is no value in that like lithium iron phosphate. For battery materials, lithium iron phosphate is in some cases used as an alternative to nickel- based lithium mixed metal oxides, but it leads to heavier vehicles, lower battery performance and thus higher energy demands throughout the use phase. So overall, the advantages of the nickel free product are substantially lower. Due to SSbD's hazard-first-approach, if SSbD were to become regulation, the company would have to end their R&D of nickel-based battery materials at least in Europe. There are many examples in the industry, where using hazardous metals leads to higher performance, longer lifetime and recyclability, ultimately resulting in a more sustainable product. In addition, recyclability of metals is seen as important to reduce Europe's dependency of imports.

SSbD in its current form implies looking at hazards upfront. It is seen as a disadvantage that SSbD starts before the real R&D of materials begins as it would narrow the options and thus reduce the opportunities of R&D. Usually, different materials are used in certain applications for a good reason – even if they are costly or hazardous, there is often no better alternative. That SSbD might forbid some of these materials is a major concern for the company. SSbD should not focus on hazard only, because humans are capable of handling dangerous tools in a safe manner. The company sees SSbD as a threat as it oversimplifies the individual material considerations.

**The Innovation process at a materials technology company**

The innovation process in the company starts in the R&D departments at lab scale. Already at this stage all EHS relevant information is taken into consideration to identify safety requirements for handling and also later application.

Based on the results of the R&D phase materials are tested under application conditions and if successful up-scaled to pilot process stage for materials qualification by customers. This is followed by transfer to production scale.

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**Functions within a materials technology company in need of thorough SSbD knowledge**

- EHS department
- Governmental affairs, public affairs roles
- R&D department

For safety, the company has specialists in a specialised department. Knowledge about the hazards of the metals they are handling is well established within the organisation. This department also addresses sustainability issues.

**Trainings gaps & needs**

- Safety training of new employees
- Sustainability training for the whole company
- Providing knowledge to their customers
- Industry associations

Whenever a new colleague arrives, the company follows the standard procedure of safety trainings as a first priority. For sustainability, the company offers internal trainings in which they explain how they aim to close the loop via materials development, materials production and recycling. Closing the loop is an integral part of the company's business.

Their customers, mostly OEMs, are asking the company about sustainability information/EoL options. In the case of the introduction of a new battery material its recycling is already a topic. The company shares their knowledge with the customers and offers battery recycling as a service.

To stay informed, industry associations play an important role in the sector. They inform the companies about new regulations, have access to ministries and the EC, and organise workshops and public hearings. They not only spread information, but also collect input from within the industry to channel that towards ministries and the EC.

The company representative acknowledges that awareness on safety exists, and that sustainability is more and more included in the chemistry curricula of universities and technical schools. However, a fully green chemistry focus is still niche. In academia, a lot of scepticism about SSbD can be found as the variety of materials are seen as a useful "toolbox" for the students. Not everyone in academia in Germany is aware of SSbD yet.

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## 4.4 Packaging sector

### 4.4.1 Packaging sector – interview 1

**Interview partner (person & company)**

The interview partner for the packaging sector was the R&D Director at global supplier of food packaging solutions.[5] He is responsible for West Europe, including UK, Benelux, France and Spain and based in the French plant. He has been working in R&D for 25 years.

The supplier belongs to a family-owned company group from Europe. Packaging is their biggest unit, covering 60-65% of their activities. Packaging is divided in 10 units in Europe and 10 units in North America. In Europe, the supplier provides packaging for the food and medical industry. Their main sites are in Finland, Germany and France. The supplier's main material is films, mainly plastic packaging and some paper laminates and paper films.

**SSbD relevance at a packaging supplier**

The SSbD Framework as such was unknown. However, the topics safety and sustainability play an important role for the packaging sector.

**The approach on safety and sustainability at a packaging supplier**

In the packaging industry, safety is understood in terms of food safety: the priority is to protect the food to combat food waste. The supplier ensures that their product is robust enough and the gas barrier intact for the whole shelf life. It is important that there are no substances in the films that could migrate to the food. The regulatory landscape for these substances changes rapidly. The supplier ensures compliance and aims to anticipate changes before they become law.

The packaging industry often gets criticised for using plastic packaging. However, packaging only accounts for 5% of the CO2 emissions, whereas the food content accounts for 95%. The supplier started discussing sustainability topics 15 years ago and has noticed an increasing interest in the last 5 years.

For the sector it is important to reduce the use of raw materials: The supplier aims to use the material as efficiently as possible and possibly reusable and advises their customers to use packaging only if it is necessary.

The sector is focussing on enabling recycling for a circular economy. The packaging industry has to balance the trade-off between functionality and circularity. For the packaging industry it is a difficult journey as they almost have to reverse what they were doing for decades: For the last 30 years the aim was to develop multi-material films to reduce thickness and use less material. Now, they have to go from material diversity to mono-materials like polyolefins (mono PE, mono PP) that are recyclable. In the last five years, the supplier and other packaging companies developed packaging for the kind of applications for flexible

[5] Microsoft Teams online interview, Lutz Walter (Textile ETP) and packaging value chain representative 1 (a global supplier of food packaging solutions), duration: 60 minutes, date: 16 November 2023.

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packaging that can be recycled: a mono polyethylene (mono PE) or mono polypropylene (mono PP) film.

According to the interviewee, the packaging industry considers biodegradable materials as a disturber for recyclability of mono PE or mono PP. To enable recycling, he emphasizes the importance of well sorted specific packaging waste streams to not destroy other waste streams. The only stream existing in Europe can be found in Italy and in some states of the USA.

**The innovation process at a packaging supplier**

The most common way to develop innovation at the packaging supplier is to work on specific projects or specific tasks together with machine suppliers, brand names, and food producers. The supplier is also involved in specific collaborative EU projects.

**Functions within the packaging supplier in need of thorough SSbD knowledge**

- EU policy expert
- Quality department
- Sustainability manager
- Product sustainability manager
- R&D department & technical experts

**Trainings gaps & needs**

- Sales representatives
- Providing knowledge to their customers

On the safety side, the supplier works with external experts to help them stay on top of food safety and food contact issues. At national level, they are part of unions, who have dedicated people to support the supplier on food safety topics like new legislation, food contact and migration substances. Internally, at group level, the supplier has one person, who is an expert discussing new developments at EU level. Their local quality departments ensure that the supplier complies with the Food Safety Global Standard (BRC) and runs audits. The quality departments help their customers, who are often medium-sized companies, for example, on filling in safety questionnaires.

On the sustainability side, the supplier has dedicated people at group level like a sustainability manager and a product sustainability manager and the R&D department is involved with sustainability in all units. Sales representatives need to explain the new sustainable product ranges, which is often difficult for them as the topics are very technical. It is part of the role of R&D and technical experts to train the sales representatives and their customers in the sustainability field.

For the supplier it is challenging to attract young talent with expertise. Plastic packaging is seen as something bad and not attractive, which makes it difficult to catch good educated young people. Furthermore, plastic packaging producers are not well-known worldwide, so to attract more young talent the supplier goes to schools, makes trainings and explains what they are doing, that plastic packaging is not only bad and offers a lot of technical opportunities to explore and contribute to a better future.

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There are some schools in Germany, France and the Netherlands, where education programmes on food packaging exist. The most common way though is that people learn from the company.

### 4.4.2 Packaging sector – interview 2

**Interview partner (person & company)**

Another interview partner for the packaging sector was the Group Director of External Affairs at a leading supplier of circular food packaging.[6] He is involved in the sustainability aspects, sustainability regulation and internal sustainability strategy. He has a background in chemistry and has been working for 20 years in the packaging industry. He is based in France. The supplier is a medium-sized company and leading in the category of plastic rigid packaging, including trays, cups, tubs, for food application into all segments (dairy, protein, ready meal, food service). It is a converter company supplying packaging solutions to their customers, who can be industrial (Danone, Nestlé, Unilever, Lactalis...) or retailers (TESCO, LIDL, CARREFOUR, LECLERC, MERCADONA...). The company is mainly active in Europe with 30 factories, two in North America and one in Indonesia.

The supplier has a clear raw material strategy and is focusing mainly on PET, which they believe is the best material to develop circularity on the market for food packaging applications. They consider polypropylene as a valid alternative to PET when technical reasons justify. They do not consider polystyrene as long-term sustainable solution for food packaging; it should be slowly phased out.

**SSbD relevance at a packaging supplier**

The SSbD Framework as such was unknown. However, the topics safety and sustainability play an important role for the packaging sector.

**The approach on safety and sustainability at a packaging supplier**

Reuse, recycling and circularity are key to the supplier's sustainability strategy. FAERCH started 15 years ago to use post-consumer PET and developed skills to provide its decontamination in-house. 7 years ago, the company made the decision to become recyclers and invested in a recycling facility in the Netherlands. The RPET solutions are EFSA approved. Their vision is to develop tray-to-tray recyclability and organise a stream so that they can collect back the tray from the household waste stream to be able to sort, clean, recycle and reuse its material in their own production with the target to recycle the same amount that they put into the market. Current industrial capacity input in place is 60 Kt with ambition to reach 250 Kt after 2026. One key requirement is an as clean as possible, local stream. Therefore, when they develop new products, they avoid direct printing on the material and apply decoration that can be removed. The supplier focusses on recyclable mono-materials and uses mechanical recycling as a process. They are currently developing their own tray-to-tray recycling process at scale and extending the solution into Europe. The supplier has been pioneer in Tray-to-tray circularity and wants to support whole food packaging industry to

[6] Microsoft Teams online interview, Lutz Walter (Textile ETP) and packaging value chain representative 2 (a leading supplier of circular food packaging), duration: 60 minutes, date: 9 January 2024.

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have access to circular solution. Technologies are still new, and many efforts are done to keep improving efficiencies.

Biobased materials like biobased PET and paper are not considered valuable alternatives to plastic. For example, the supplier tested bio-PET, but the bio-percentage was only a small amount and produced far outside Europe and the company did not want to be subject to greenwashing. They also tested paper, but due to the need of plastic lamination/coatings there was no real recyclability of paper possible. The supplier wants to drive its decisions on facts and avoid misleading short-term solutions driven by emotions.

The supplier signed the Science-based Targets initiative (SBTi) commitments and aims to become net zero by 2040. They are investing into a Power Purchase Agreement (PPA) plan to source green energy.

Another important sustainability aspect for the supplier is increasing the shelf life of a product to prevent it from becoming food waste. Plastic packaging has a considerably lower CO2 footprint then the contained food.

The main safety aspect is that plastic packaging significantly helps to secure food safety. The company does not compromise on functionality.

**The innovation process at a packaging supplier**

As the company is medium-sized and has limited resources, they try to have a clear focus on some solutions, some processes and some raw materials that they strongly believe should be prioritised when it comes to investing in innovation.

The supplier is product and technology driven to propose the most innovative solution for its market at the most optimized cost. It has a product management department, which is conducting market surveys to detect trends and novelties. Technical capacity (R&D, engineers, machine and tool technology, raw material expertise) is in house to develop own technical solutions.

**Functions within a packaging supplier in need of thorough SSbD knowledge**

- Chief sustainability officer
- ESG manager
- Quality/ hygiene & environment department
- LCA specialist
- R&D department
- Chief technology officer
- Packaging developers
- Project manager

**Trainings gaps & needs**

- General understanding of the whole company

To identify innovation priorities and access knowledge that they do not have in-house, the supplier partners with different external bodies. One is experts from different trade associations to increase network, knowledge on wider scope and to have access to more specialists. They help the company to stay up to date on regulation, compliance, and scientific developments. The supplier has also some partnerships with universities,

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which can provide strong scientific support, which is required to better understand technical operational aspect and to progress. This is part of a long-term investment as universities are most of the time focusing on academic and fundamental research, which is useful for longer term issues. The company also works with external consultants' scientific laboratories and applied research centres like IPC, as they are closer to the industry and build a bridge between long-term innovation and short-term industry issues.

The supplier needs to increase its level of internal knowledge on all sustainable aspects by continuous education (safety compliance, hygiene, LCA…), which is required to be understood across all internal value chains (sales, development team, Quality, Health, Safety and Environment (QHSE) team management...). Most of the education is done internally by regular newsletters and webinars organized by specific departments to spread internal knowledge.

Globally, recruiting in industry is not easy as it is not really attractive, so the supplier is working on better communicating its efforts and increasing its visibility. Recruitment of younger people is even a bigger challenge as they have very low understanding about the industry. The interviewee's impression is that universities are developing stronger sustainability education, even though students still require in-house training at the company afterwards, it provides them with a sensitiveness regarding sustainability aspects. Working on sustainability is seen as something that can make a job position more attractive to young people.

## 4.5 Textiles sector

### 4.5.1 Textiles sector – interview 1

**Interview partner (person & company)**

The interview partner for the textiles sector was a business developer and manager at an SME of textile production.[7] The SME runs a micro factory, specialized in industrially digitally printed textiles. The interviewee studied textile and clothing engineering and textile management. His role involves managing tasks related to product management and ecosystems, focusing on economically and environmentally feasible solutions for SMEs. While not directly involved in operational work, he oversees various research projects, for example, innovation in digital IT scheming and improving ink systems.

**SSbD relevance at a textile SME**

The interviewee was first introduced to the SSbD Framework during the EU-funded HEREWEAR project, wherehe is a consortium partner. [8] The project utilized the SSbD Framework to research different design approaches. They developed polo shirts in which they tried to incorporate the different design principles of the Framework as well as additional considerations like local production.

[7] Microsoft Teams online interview, Lutz Walter (Textile ETP) and textile value chain representative 1 (an SME of textile production), duration: 60 minutes, date: 12 January 2023.
[8] HEREWEAR, Nio-based local sustainable circular wear, accessed 30 January 2024, https://herewear.eu/.

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He believes it is essential to communicate the SSbD Framework to single designers /SMEs not closely associated with universities. In particular, small companies can benefit from this approach, especially those that do not typically organize their sustainability efforts systematically. The company encourages collaboration with universities, recognizing the importance of staying informed and working closely with educational institutions.

**The approach on safety and sustainability at a textile SME**

In the textile sector, the raw material choice the fabric and the garment concept are crucial elements that influence the sustainability of a product. As a SME, the company caters to different kinds of clients, who care more or less about making sustainable material choices. As a manufacturer, the company's choices respond to client requirements and order volumes. On the social sustainability side, ethical and social aspects are very important for the company's management, and the company actively promotes working with young designers.

Clients are increasingly interested in sustainability, although the final buying decision for this type of product is only growing at a modest rate. In their customer base, the usual requirement to get an order remains to ensure overall reliable and price effective delivery. Often, their clients' knowledge about sustainability concepts is fragmented, i.e., some focus on sustainable raw materials, others on fair production conditions. A holistic approach, which aims to combine safe, sustainable, functional, and social metrics, is rare. For SMEs that do not have a sustainability department, an understandable and accessible tool would be of great value. For example, in the HEREWEAR project, the University of the Arts London developed so-called BioTEN cards, which aim to address the need for practical implementation of sustainability in design decisions by providing actionable knowledge about biobased fibres and materials.[9] The partner Circular.fashion developed a data-driven, practical, intuitive decision-making tool to support designers in making more sustainable choices in the product design process.

Concerning safety, the company follows what the client asks for. They choose to work with partners who will fulfil what is required by the client.

**The innovation process at a textile SME**

The management board at the company first defines a project and provides contacts from the industry, universities or institutes. Then the business development department takes over and creates the project team, meetings and work packages. Important updates get discussed with the management board. The majority of impulses for innovation activities are based on customer needs or feedback from the sales team that is closest to the market.

**Functions within a textile SME in need of thorough SSbD knowledge**

- Apparel designers
- Material sourcing
- Product developers
- Technical textile experts

[9] Earley, Rebecca and Forst, Laetitia and Sandu, Elvys and Spataru, Andreaa (2023) BioTEN BURRR: Exploring current use, reuse, repair and recycling practices for bio-based clothing towards guidelines for circular fashion designers. In: 4th Symposium on Circular Economy and Sustainability, 19-21 June 2023, Heraklion, Greece. Accessed 30 January 2024, https://ualresearchonline.arts.ac.uk/id/eprint/20093/.

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- Production
- IT
- Sales

For a small company like this one, SSbD knowledge across all levels within the company is important. A few people with a holistic view of the industry should bring together technical, chemical, production, design, business, and IT considerations.

Knowledge sources for design decisions vary within the company. Apparel designers often focus primarily on aesthetics and possess superficial sustainability knowledge obtained from social media. They know that they should be "green", but do not know about chemical specificities. People in the operations like material sourcers, product developers and technical textile experts contribute deeper insights. Salespeople at the company tend to have more SSbD knowledge than designers, as they gather information from market research, store visits, and direct client interactions and are driven by understanding the clients' needs.

**Trainings gaps & needs**

- Apparel designers
- SME incentives

Acclaimed design universities tend to be more progressive on teaching students to work with innovative materials and sustainable fabric alternatives. At other universities the focus is more on functionality and understanding the data and production flow; sustainability gets considered to a lesser extent.

For education and training, the interviewee suggests that the EU could incentivize SSbD education by providing real orders to companies. This would allow smaller companies to invest in sustainability solutions.

The interviewee sees a clear risk in sustainability and circularity regulations, since small companies may be forced to re-organize cashflow and other sources for investments, depending on what regulations will be like effectively. Collaboration among small companies could be a potential strategy to navigate these challenges. Therefore, there is a need for careful consideration of regulations to avoid unintended consequences that might adversely impact smaller businesses.

### 4.5.2 Textiles sector – interview 2

**Interview partner (person & company)**

Another interview partner for the textiles value chain was a Technical Director with 35 years of experience working in the personal and protective equipment (PPE) industry.[10] The company is a diversified Group with an extensive portfolio of products and activities: spinning, weaving, and coating of technical textiles, manufacturer of professional protective clothing and producer of fine chemicals.

[10] Microsoft Teams online interview as part of the temporary working group on safety & sustainability assessment of innovative materials for workwear and protective clothing, Lutz Walter (Textile ETP) and textile value chain representative 2 (global leader for technical textiles and protective clothing), duration: 45 minutes, date: 10 October 2023.

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The company is a partner in the EU-funded CISUTAC project and actively involved in the development of Eco-Design (Design for Circularity) Guidelines for PPE as part of the project, which he discussed during the interview.[11]

**SSbD relevance at a PPE company**

The interviewee is familiar with the SSbD Framework and suggests its use to assess low technology readiness level (TRL) developed chemicals as part of his Eco-Design Guideline recommendations. He also participated in a temporary working group on safety and sustainability assessment of innovative materials for workwear and protective clothing that was organised by Textile ETP in autumn 2023.

**The approach on safety and sustainability and the innovation process**

In the PPE industry, safety is understood as ensuring health and well-being of the professional user by providing protection, comfort and durability. The company follows strict safety requirements and corresponding EN/ISO standards. For a PPE buying decision three parties, who focus on different aspects, come together: the buyer (price, LCC), the safety officer (protection, risk analysis) and the users/unions (comfort, image). At the moment, only a minority of customers asks for environmentally friendly or otherwise more sustainable products.

The company's approach to designing sustainable PPE products revolves around the Eco-Design Strategy Wheel, formerly called LiDS Wheel, which goes over the different lifecycle phases of a product (Figure 3).

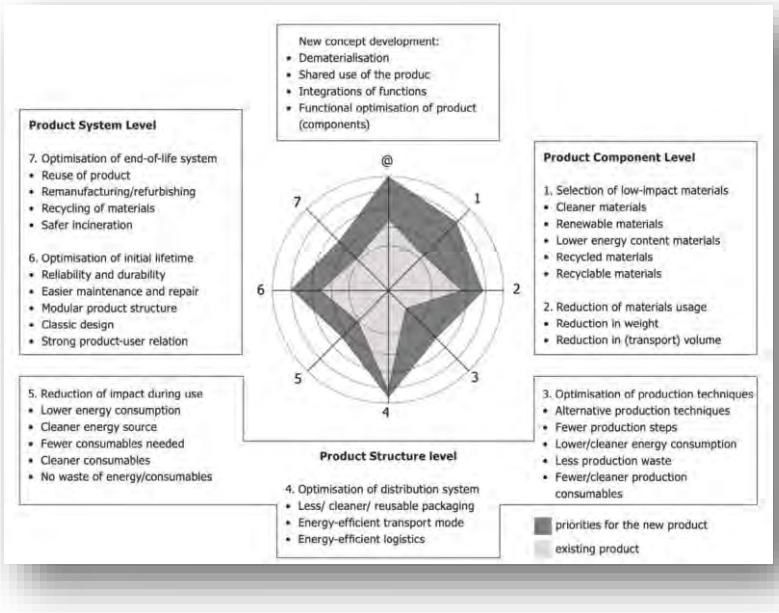


*Figure 2: The LiDS Wheel (TU Delft, Brezet and Van Hemel, 1997)*

[11] CISUTAC, Circular and Sustainable Textiles and Clothing, accessed 30 January 2024, https://www.cisutac.eu/.

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Many sustainability considerations within the PPE industry depend on the functionality, the product, its use, and the customer. The interviewee shares some sustainability challenges of the PPE industry as examples:

1) To enable recycling, a challenge for the industry is that even with applying only safe chemicals in the production process, after its use, the product will be contaminated with volatile organic compounds (polycyclic aromatic hydrocarbons), oils, greases etc., which can be hazardous. After use, they need to eliminate them to reach compliance again, which is often very challenging.
2) Durability is an important criterion, but not for all PPE. For instance, as the decontamination of asbestos fibres is still not achieved, the products have to be disposed of together with the contamination after use.
3) In the waste hierarchy pyramid, re-use has a higher priority than recycling. However, re-use in form of selling on the second-hand market of some PPE products, for example, a police uniform, can lead to “less noble intentions”.

The emphasis in the PPE industry remains on the longevity and durability of products. In contrast to fashion or active goods (tents, backpacks etc.), PPE products have to ensure compliance with EN/ISO standards, consider the total cost of ownership and address specific product and quality requirements. The interviewee sees it as vital that eco-design gets recognised by EN/ISO standardisation groups. Sometimes, the company is hindered to work with innovative eco-design approaches because of specificities asked for in a standard or public procurement tender. He stresses that PPE, being highly certified and standardized, requires unique considerations in upcoming regulations.

For future eco-design of textile products, the Eco-Design Guidelines of the CISUTAC project foresee the following design strategies: design for reliability, use, longevity, durability, materials selection & design for optimized resource use, sustainable behaviour (use), energy efficiency, logistics (packaging & distribution), manufacturing, assembly, disassembly, reuse and repurposing, care (cleaning), repair & maintenance, remanufacturing and refurbishing, recycling, and composting.

**Trainings gaps & needs**

Within the company, designers need training, for instance, to understand the specific requirements for disassembling products before recycling. The CISUTAC project aims to develop a tool to train designers in eco-design, recognizing that designing PPE differs significantly from fashion items. Whereas the Eco-Design Strategy Wheel has been proven to be easily understandable by their designers, the different aspects of the ESPR that the EU is currently working on are considered overwhelming.

In the PPE industry tenders for public procurement play an important role. The interviewee points out that depending on what is written in them strongly influences where the companies set their focus. For example, a minimum amount of recycled content or a focus solely on the purchase price can jeopardise a company’s work on an innovative and more costly products/processes.

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# 5 General findings

The interviews confirmed what D4.4 also found, namely that safety as a concept has been around for far longer than sustainability in all analysed sectors, therefore it is much better established, embedded in regular procedures and is clearly and well regulated.

Differences, however, can be noticed regarding the focus of safety in the supply chains, which often prioritizes human safety, but in different aspects (e.g., workers, end users, etc.), in other instances, environmental safety (e.g., raw material sourcing, byproducts polluting natural waters, EoL treatment) or sometimes even the safety of the process or product itself, from pollution generated by human presence (in the electronics sector).

Sustainability, as a much less mature concept is less regulated and therefore more ambiguously present in the various sectors – at this time, often more present on a strategic level or topically at operational level for sustainability aspects that play a particularly prominent role i.e. recyclability of packaging or safe sourcing of battery metals.

Several value chains, however, undertake efforts to more holistically approach sustainability and a circular economy in the future. This long-term vision requires investments in a new infrastructure and in the development of new materials/products/processes. Besides time and resources, these developments require a company-internal change of mindset as well as of their customer and consumer base.

Following the first findings in D4.4, we were able to confirm and extend the list of key roles and functions within companies, which would need (deep) SSbD knowledge. Several, sector-specific roles were mentioned, however some functions stood out, as these were mentioned in several interviews:

- Design professionals – confirmed (incl. Product developers)
- Product stewardship professionals – confirmed (incl. Regulatory, EU policy, governmental affairs roles)
- Quality managers – confirmed
- Sustainability experts – confirmed (incl. ESG, CSR, LCA, EHS roles)
- Technical sales professionals – confirmed (not only technical sales, but sales in general)
- Research & Development experts – confirmed (incl. Innovation experts)
- Procurement experts – confirmed
- Material engineers – confirmed
- *Purchasing experts (incl. material sourcing, material supplier) – new*
- *Manufacturer specialists – new*

Whereas in each company several functions with a certain need of knowledge on either safety or sustainability or both were found (see above), for some functions a specific training need on safety and sustainability could be identified. Once again, several sector-specific roles were mentioned, however some functions stood out, as these were mentioned in several interviews:

- Design professionals
- Sales and service professionals
- General management

Existing training practices on safety and sustainability differ and are conducted separately.

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Larger companies and those where strict safety rules have been in application for a long time, have well-established internal and sometimes externally supported training practices for safety procedures and practices. Smaller companies rely more heavily on information and training provided by suppliers of chemicals, materials and processing technologies or specialised external training providers. The following SSbD-related training providers were mentioned several times:

Safety trainings are provided by:

- Mostly in-house training (internal)
- Sometimes trade unions (external)
- Supplier of chemicals, materials, and processing technologies (external)
- Sometimes specialised training provider (external)

For sustainability, skills acquisition is less formalised both in terms of subjects and delivery and in addition to regulation also heavily depends on individual company strategies or market-driven demand for sustainable products and services.

Sustainability trainings are provided by:

- In-house training (internal)
- Consultants (external)

Specific SSbD trainings/information is provided by:

- Industry associations (external)

In general, it is seen that European universities include sustainability topics increasingly in their curricula. Nevertheless, all new employees require internal training on specific safety and sustainability topics and procedures, applicable in the relevant sector or supply chain stage. Some general understanding of chemistry and materials science was mentioned as important to fully grasp the implications of the SSbD.

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# 6 Challenges and limitations

It should be kept in mind that the findings of D4.10 mostly represent the views of large companies. The SME insights we obtained were minor and need to be further investigated. Further, the limited number of interviews can only provide first insights into the respective sectors, one should be careful to draw sector-wide conclusions from them. Due to the semi-structured nature of the interviews and the limited one-hour timeframe, not all questions of the questionnaire were answered in detail each time, which made it challenging to compare the different sectors. Often, a significant amount of time during the interview had to be used to explain what the SSbD concept is. Although we asked about current training techniques and providers in each value chain, there was either not sufficient time to discuss or the interviewee did not know the specifics of the internal training content. This should be subject to further research.

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# 7 Conclusion and recommendations

As next steps we suggest filling the research gaps mentioned in chapter 6 about challenges and limitations.

In general, we see the need to make the current SSbD Framework less complex and more flexibly adjustable to sectoral needs and more limited capacities of smaller companies. The companies across all value chains are aware of safety and sustainability topics. The decision-making on safety issues is well established. The decision-making on sustainability issues is where all companies still struggle due to high investment needs, the necessary time to build up a sustainable sector-wide infrastructure, a lack of data and uncertain regulations, amongst others. Interrelated thinking across all company departments is seen as highly important and encouraged by the interviewed professionals. The companies are clearly in need of practically available, intellectually accessible tools that are somehow linked to their workflow and decision-making progress. This ideal tool might require corresponding training activities. Especially the larger companies already defined their sustainability strategies and some already developed their own assessment and decision-making tools for which they develop their own trainings. It can be seen as beneficial to aim for an interrelated, harmonised approach and a common tool. However, this needs to be set-up in due time as with companies already move forward in the anticipation of sustainability regulations. It would be advised to adjust the SSbD Framework accordingly and tailor it to each sector.

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# 9 Annexes

## Annex I – Detailed information about interviewed company representatives

Microsoft Teams online interview, Lutz Walter (Textile ETP) and automotive value chain representative (a global supplier of technology and services), duration: 60 minutes, date: 16 November 2023.

Microsoft Teams online interview, Lutz Walter (Textile ETP) and electronics value chain representative (a multinational cooperation and technology company/an international roadmap organisation), duration: 60 minutes, date: 18 December 2023.

Microsoft Teams online interview, Lutz Walter (Textile ETP) and energy materials representative 1 (a global leader in innovative products based on science and chemistry), duration: 60 minutes, date: 9 November 2023

Microsoft Teams online interview, Lutz Walter (Textile ETP) and energy materials representative 2 (aa multinational materials technology company headquartered in Europe), duration: 60 minutes, date: 28 November 2023.

Microsoft Teams online interview, Lutz Walter (Textile ETP) and packaging value chain representative 1 (a global supplier of food packaging solutions), duration: 60 minutes, date: 16 November 2023.

Microsoft Teams online interview, Lutz Walter (Textile ETP) and packaging value chain representative 2 (a leading supplier of circular food packaging), duration: 60 minutes, date: 9 January 2024.

Microsoft Teams online interview, Lutz Walter (Textile ETP) and textile value chain representative 1 (a SME of textile production), duration: 60 minutes, date: 12 January 2023.

Microsoft Teams online interview as part of the temporary working group on safety & sustainability assessment of innovative materials for workwear and protective clothing, Lutz Walter (Textile ETP) and textile value chain representative 2 (a global leader for technical textiles and protective clothing), duration: 45 minutes, date: 10 October 2023.

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## Annex II – Semi-structured interview guide

I. **Identification**
   a. Name + Position + Background
   b. Company - Name, Core business, Location
   c. Functional description of the position
      i. Objectives
      ii. Tasks/KPIs

II. **Existing knowledge on SSbD**
   a. Have you ever heard of SSbD
      i. If yes, specify your level of knowledge
   b. Do you think that SSbD is relevant for your org / position?
      i. If yes, how? Pls specify
   c. Which other positions in your company may have knowledge about SSbd?
   d. Which stakeholders around your company (clients, agencies, consultants, etc) may have knowledge about SSbd?
   e. Why do you think the identified knowledge gaps exist?

III. **SSbD knowledge/skills needs**
   a. Describe what you'd need / like to know or learn about SSbD
   b. Which other positions in your company would also need to acquire knowledge about SSbd?
      i. What type of knowledge is missing? What type of skills are missing? - pls specify
   c. Which stakeholders around your org (clients, agencies, consultants, etc) would also need to acquire knowledge about SSbd?
      i. What type of knowledge is missing? What type of skills are missing? - pls specify

IV. **SSbD education or training**
   a. What type of education / training subject would be needed in your company?
   b. What type of education / training formats would work best in your company? Would something like this training session for SMEs be useful for you?
   c. Who should deliver this kind of training?

V. **Final remarks**

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