Portfolio Sustainability *Assessment v2.0*

A framework developed by leading chemical companies for all sectors

World Business Council *for Sustainable Development*

Contents

Foreword

The World Business Council for Sustainable Development (WBCSD) published the **Portfolio Sustainability Assessment (PSA)** *in 2018. Since then, methodologies developed based on the PSA Framework have supported organizations in embedding complex, interconnected sustainability topics into businesses decision-making and steering product and service portfolio performance toward sustainability.*

With the PSA Framework's adoption by businesses, experience and practice have proven that it supports companies as they navigate uncertainty and in making better decisions that reduce risks and socio-environmental impacts. It has also proven to be relevant across sectors, beyond the leading chemicals companies it originated from.

Significant transformations in how people live and conduct business call for the adaptation of the PSA Framework to reflect ongoing challenges while building agility to adjust to future disruptive circumstances. Rapid urbanization, resource scarcity, climate change, evolving societal expectations, supply chain constraints, a progressively changing sustainability legislation landscape, and market trends are some of the factors shaping the way organizations are responding and adapting to become competitive in a manner that can create value for societies and the environment.

Leading companies behind the PSA therefore expressed the need to further develop the framework, with the ambition to evolve it progressively toward a metrics-based voluntary international standard that advances translating sustainability risks and opportunities into business solutions while fostering transparency.

This first update focuses on:

A. Spelling out how companies are using the PSA for innovation;

B. Proposing an approach to embed circularity;

C. Updating the market signals for the PSA to stay ahead of influential regulatory advances.

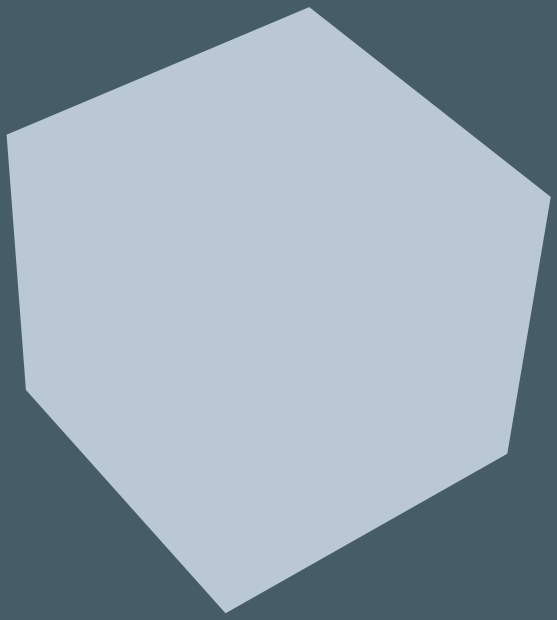
A. Innovation: futureproofing solutions with a PSA

Innovation is a key business lever upon which to foster the emergence of sustainable solutions. The PSA Framework applied in this context supports the identification and prioritization of opportunities that contribute to addressing global sustainability challenges.

Appendix IV, a new addition to this publication, guides practitioners as they integrate the PSA into an exemplary innovation-stage gate process. This includes:

→ Adjusting the scope from guiding principles in the early idea phase to progressively transition to a full PSA as solutions reach market launch;

→ Raising safety and sustainability ambitions to ensure the futureproofing of the solutions developed.



B. Embed circularity in the PSA

- According to the Global Resources Outlook,[1] linear consumption patterns are responsible for 50% of global climate change and 90% of biodiversity loss. More than 95% of products and goods manufactured today involve chemicals.[2] Optimizing resource use to meet society's needs while allowing the systems that provide resources to regenerate requires a system transformation. The circular economy is at the heart of this transformation. It is also a key lever in decarbonizing, halting global biodiversity loss, and advancing equity.
- Appendix III, which is also new, requires the assessment of the materiality of circularity in the context of product-application-region-combinations (PARCs) and proposes a fact-based approach to quantify progressively contribution to circularity.

C. Updating the market signals for PSA to stay ahead of influential regulatory advances

In recent years, sustainability has increasingly gained importance, leading to legislative initiatives advancing in all regions. These advances have been evolving considering regional and global circumstances. The Chemical Strategy for Sustainability (CSS) is one example of a regulatory development that is part of the European Green Deal with potential to influence regulatory developments worldwide. To reflect these developments, we have updated the chemical hazards and exposure (Signal Category 1) guidance and the early warning function for future expectations (Signal Category 2), covering innovation process and existing portfolios. See **Appendix II**.

[1] United Nations Environment Programme (UNEP) & International Resource Panel (2019). **Global Resources Outlook**.

[2] **The International Council of Chemical Associations (ICCA) and Oxford Economics (2019), "The Global Chemical Industry: Catalyzing Growth and Addressing Our World's Sustainability Challenges"**.

Introduction

Introduction

In recent years, attention to the sustainability performance of individual products and broader business solutions has increased substantially. Global agreements such as the Paris Climate Agreement and the United Nations Sustainable Development Goals have underpinned the importance of improving sustainability performance. The European Green Deal and other similar regional commitments have accelerated the mainstreaming of sustainability. This leads to increasing expectations for sectors, including the chemical industry, to integrate sustainability into business operations and strategies.

In support of these and other global ambitions, companies increasingly need to proactively steer their portfolios toward more sustainable solutions in line with science and society expectations. We have designed the Portfolio Sustainability Assessment (PSA) Framework to address this.

WBCSD members recognize that harmonizing approaches and developing common practices increase the robustness and credibility of their efforts, reduce complexity for external stakeholders, and contribute to building a shared language throughout value chains.

The PSA Framework originated from the chemical sector. It guides consistent portfolio sustainability assessments that steer toward superior portfolio sustainability performance.It guides consistent portfolio sustainability assessments that steer toward superior portfolio sustainability performance.

It is applicable to existing products, existing services and Innovation projects. Companies can also apply the PSA Framework logic to other sectors.

We have defined and structured the quality criteria in line with the five typical steps of a best practice PSA approach, as illustrated below.

Companies that have adopted methodologies derived from a PSA indicate that improved sustainability performance has resulted in tangible business benefits, such as:

1. Better decisions, more robust strategies;
2. Higher growth rate of more sustainable solutions;
3. Credible communication on sustainability benefits;
4. Stronger customer and stakeholder relationships;
5. Reduced risks;
6. Improved reputation.

Figure 1: Overall process for a PSA

The value of the PSA Framework

This PSA Framework aims specifically to provide a robust, yet pragmatic methodology to proactively steer (part of) an overall product portfolio beyond regulatory compliance towards improved sustainability performance.

Existing methodologies such as life-cycle assessments (LCAs) and social life-cycle assessments (S-LCAs) can form useful inputs into portfolio assessments by identifying portfolio hotspots, for example, building a comparative base for product or service performance, or offering holistic and comprehensive science-based support for decision-making. Methodologies based on the PSA Framework take into consideration additional dimensions, such as future regulatory developments and market acceptance, that provide a more rounded view of sustainability performance.

The PSA doesn't focus on aggregated company sustainability impacts, such as quantifying total company emissions or a company's exposure to child labor. Nor is the methodology suited for product labeling or comparative assertions (i.e., comparisons versus other companies' portfolios or individual products), even though companies may use individual products as illustrative examples of the methodology.

PSA approaches, because they are based on a variety of inputs including environmental and social impact, market perception, regulatory direction and other indicators, enable companies to understand the risks in the portfolio, take action and – ultimately – orient their product portfolio towards improved sustainability performance.

Ambition of the PSA Framework

The ambition of the PSA Framework is to guide companies in developing and applying consistent, high quality assessments of their product portfolio sustainability performance.

The PSA Framework aims to:

- → Build a common understanding of what is driving sustainability within product portfolios;
- → Improve robustness of existing PSA approaches by adopting best-practice approaches applied by peers;
- → Improve consistency in communication on sustainability attributes and performance.

Chemical companies use the framework to guide key decision-making processes and internal/external communications, including for:

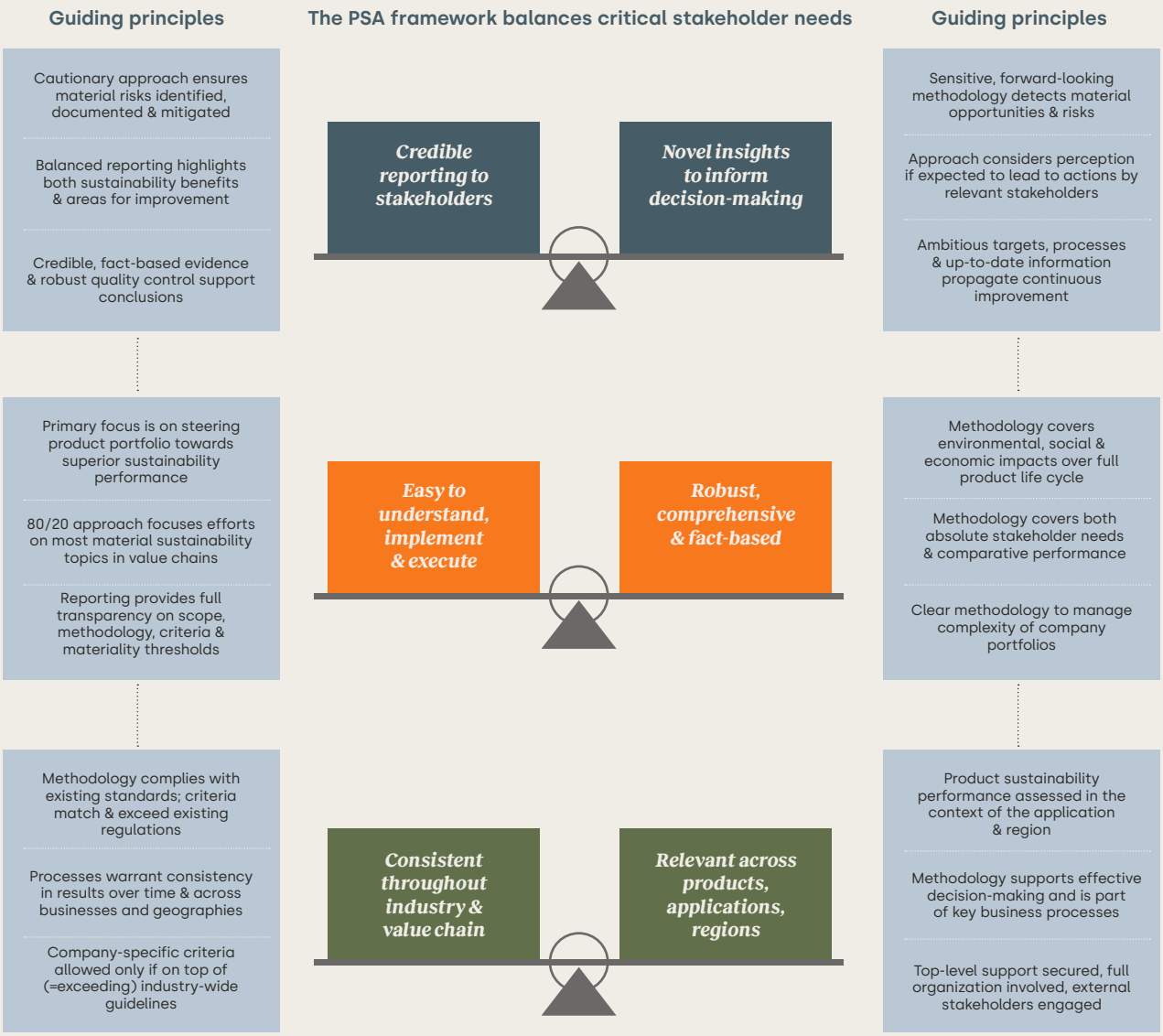
- → Risk/opportunity identification;
- → Strategy development and review;
- → (Innovation) project management;
- → Capital expenditure decisions;
- → Mergers and acquisitions;
- → Sales planning and customer co-development projects;
- → Portfolio steering through setting targets;
- → External communication at the product and the portfolio level;
- → External communication in customer/partner relationships.

The versatile use of PSA outcomes for key business decision-making implies that it is critical for PSA methodologies to simultaneously address the multiple – and sometimes contradictory – objectives of stakeholders.

Effective PSA methodologies must, for example:

- → Provide credible reporting on sustainability performance that companies can communicate to internal stakeholders and the outside world. At the same time, the PSA Framework must be sufficiently forward-looking and sensitive to spot any material opportunities and risks to provide novel insights to inform decision-making.
- → Be easy to understand, implement and execute, minimizing the barriers to start working with PSA. The PSA Framework must also ensure that assessments are robust, comprehensive and fact-based so that companies can effectively use PSA outputs for decision-making.
- → Guarantee an adequate level of consistency across industries and value chains to create a common language on sustainability performance that is relevant across a varied landscape of products, applications and regions.

Figure 2: Guiding principles to support the needs of key stakeholders



Complying with the PSA Framework

We have defined the requirements in these chapters using the terms "shall", "should", "may", and "can", in conformance with International Organization for Standardization and the International Electrotechnical Commission (ISO/IEC) directives (2011):

- → "Shall" indicates a requirement;
- → "Should" indicates a recommendation;
- → "May" indicates that something is permitted;
- → "Can" indicates that something is possible, for example, that an organization or individual is able to do something.

Companies claiming compliance with this PSA Framework document shall:

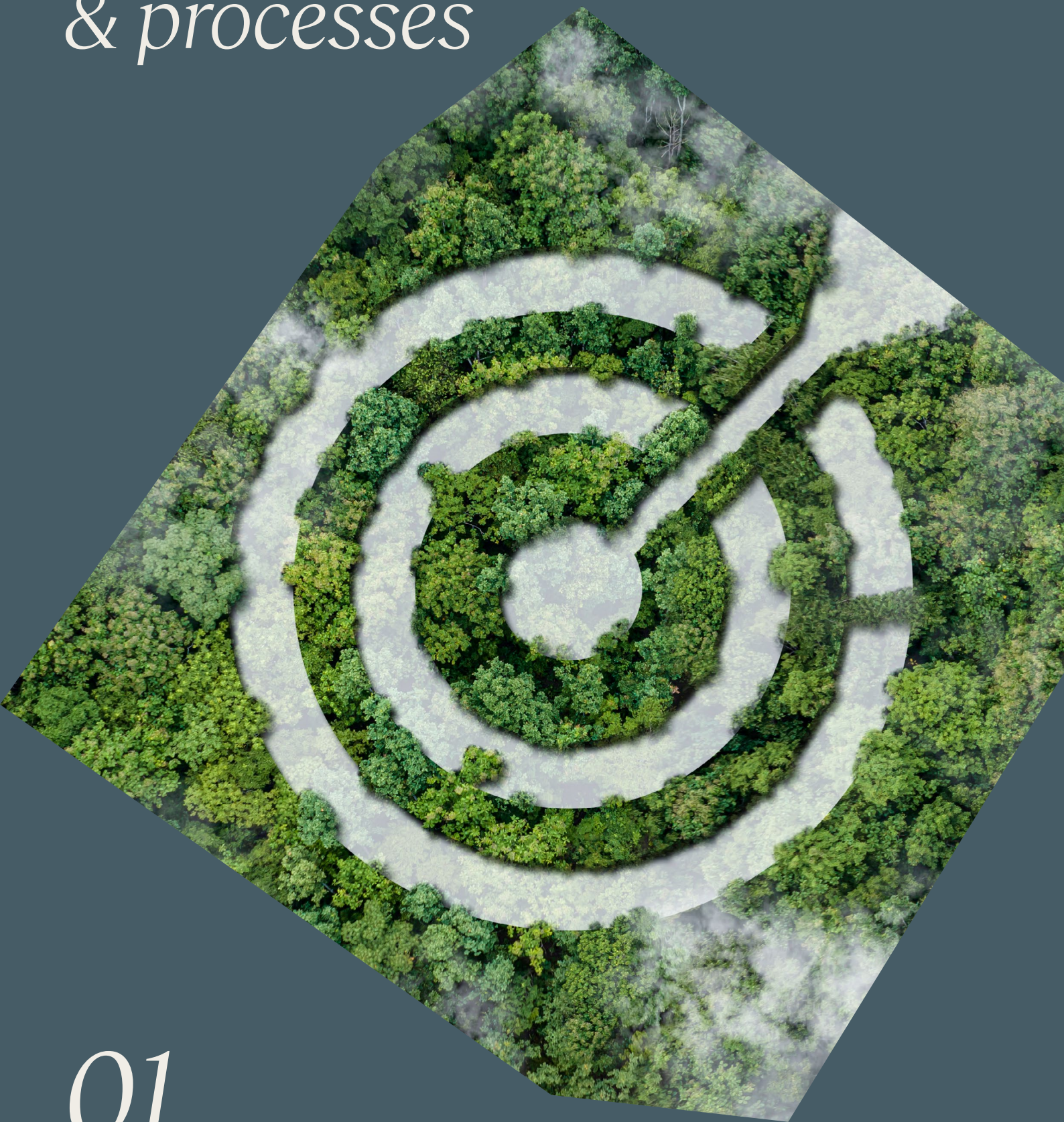
- → Follow the five steps described below;
- → Comply with quality criteria defined for each of the steps, as summarized in the following chapters;
- → Comply with existing guidelines/standards and on commonly accepted sustainability metrics where possible and relevant.

Innovation and competition also drive improvements, market requirements and regulations evolve. What is seen as superior performance today may therefore become over time average or inferior performance.

Therefore, it is necessary to review the PSA Framework and results on a:

- → Regular, structured basis (at a minimum every five years) to ensure that the facts underpinning the assessment are still valid;
- → Ad-hoc basis, when a reason exists to believe that it is necessary to update the assessment because of important changes in the market (e.g., new regulation, industry initiatives, etc.).

STEP I:
Defining objectives, scope & processes



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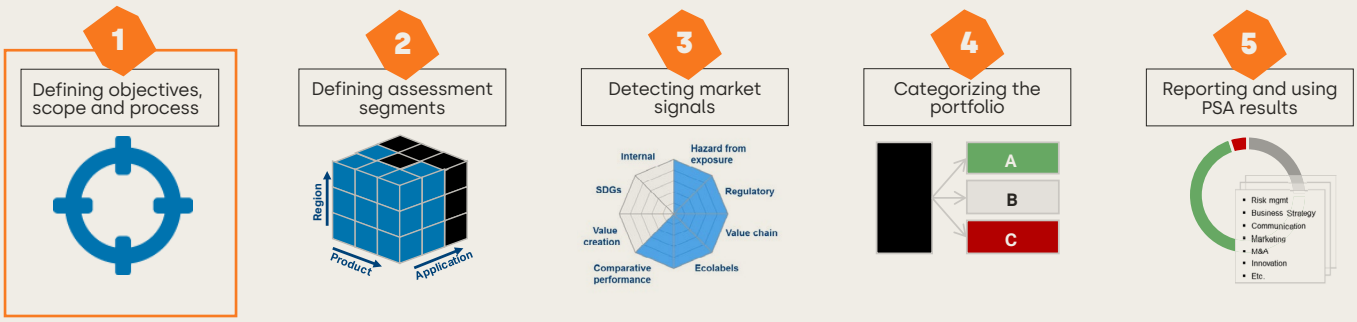
01. STEP I:
Defining objectives, scope & processes



1.1 Key to successful PSA implementation

Companies that have successfully implemented PSA processes noted that a number of practices had been critical to the successful implementation of PSA within their company:

- → Full support from company board and executives;
- → Engaged key (internal and external) stakeholders;
- → Use of multi-disciplinary teams for PSA implementation to stimulate acceptance and use of the methodology;
- → Centralized coordination of PSA implementation to warrant consistency in results over time and across businesses and geographies;
- → PSA thinking engrained throughout the full company and its key decision-making processes.

Companies must agree on PSA objectives, scope and processes upfront to ensure that all key stakeholders have a shared understanding of the journey a company is undertaking.

1.2 PSA scope

The primary scope of a PSA includes all activities covered by a company's external financial reporting ("relevant activities").

It is necessary to include business topics subject to controversial sustainability performance. Before deciding on the scope of business activities to include in the PSA, companies should conduct a high-level screening of the complete portfolio.

The high-level screening ensures that a company has an adequate understanding of where potential sustainability concerns are in the portfolio. Reporting shall include a clear justification and rationale for activities included in and excluded from the primary scope.

Following the high-level screening, a company may decide to:

- → Include all activities in scope of the PSA (full scope), with a focus on existing products, existing services and innovation projects[3]

Select a part of the business (e.g., one business unit) for assessment:

- → Exclude activities from the scope of its assessment (e.g., because they regard some activities as non-core, activities that they will divest in the short term) provided that excluded activities:
  - – Do not contain any activities for which they identified controversial items or critical sustainability impacts during the analysis;
  - – Are described (what is excluded) and justified (why is it excluded) in reporting.

Experience has shown that the gradual implementation of PSA is practical. If a company opts to gradually increase the scope of business covered), reporting shall be transparent in its explanation of:

- → How it identified the scope;
- → What activities it excluded;
- → What the company roadmap and milestones are to progressively cover all revenues.

Companies shall fulfill the quality criteria on the defined scope mentioned throughout this document.

[3] See Appendix IV – PSA for innovation.

1.3 Implementation pathway

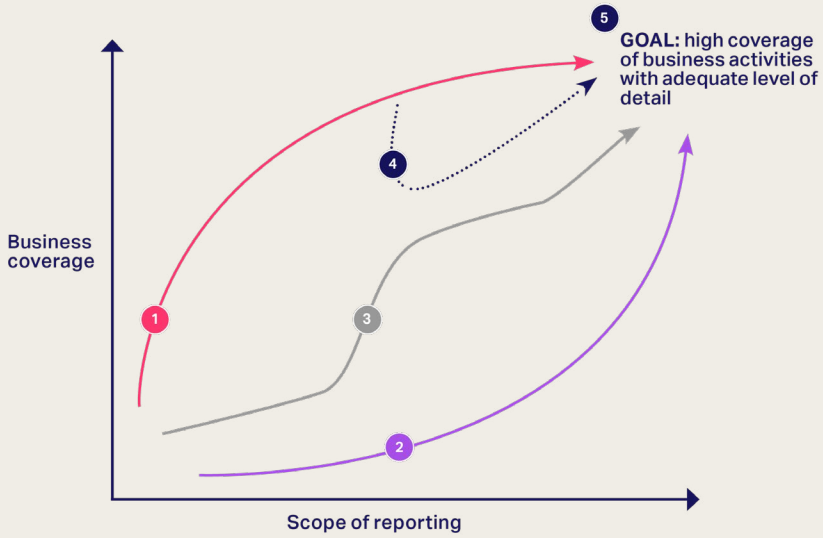
Participating companies have experienced different routes to successful PSA implementation, as shown in Figure 4. This includes:

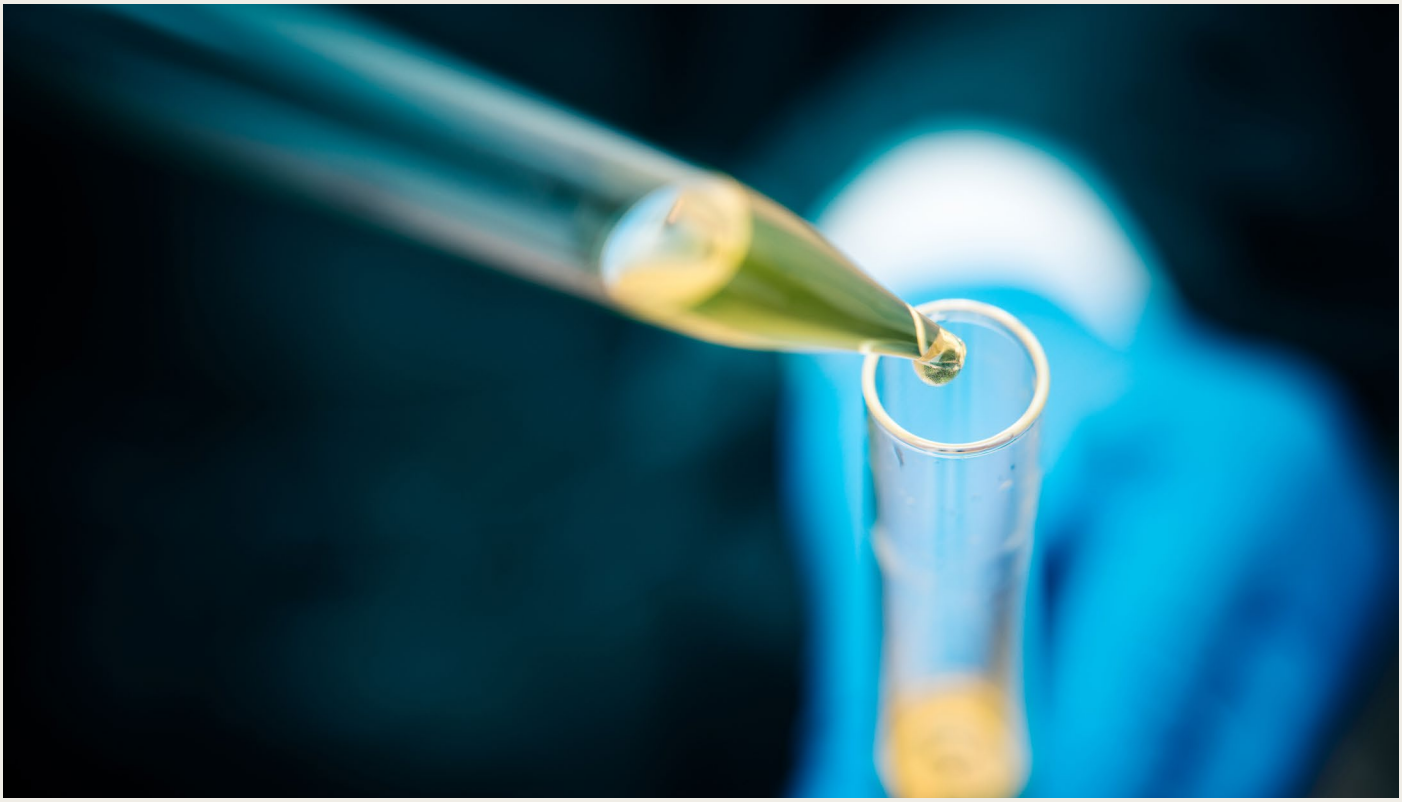
1. Involving a broad range of business activities and gradually increasing the scope of reporting over time;
2. Opting to introduce PSA in one business, realizing a high-quality, detailed pilot, and then rolling it out to other businesses;
3. Combining the above approaches and implementing a roadmap planning successive upgrades in scope and granularity, with further expansions of business coverage.

In practice:

→ Mergers and acquisitions may result in a temporary reduction of business coverage or a temporary decrease in the level detail or quality of available data. Corrections happen over time. Most companies strive to achieve a high coverage of business activities with an adequate level of detail in the assessments. However, that end-goal is an ever developing target, as stakeholder requirements change over time, new ambitions arise and portfolios change.

Figure 4: Illustrative pathways through which companies may achieve high coverage of business activities





STEP II:
Defining the unit of analysis

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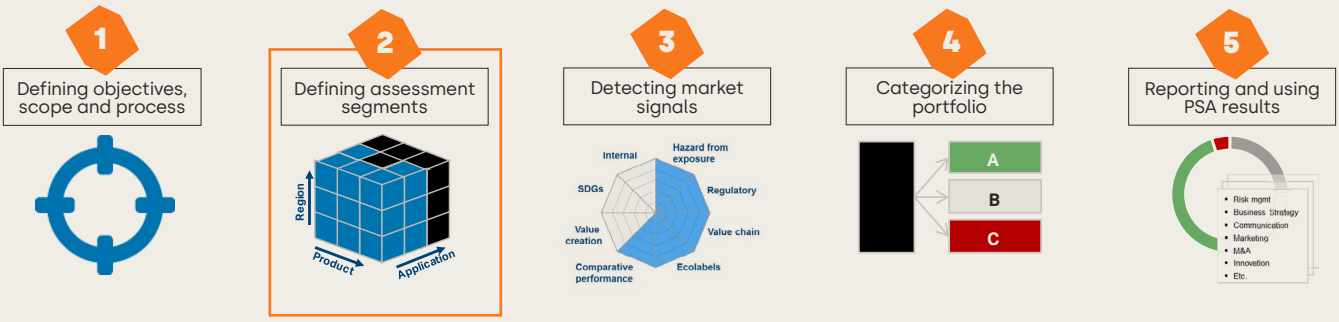
02. STEP II:
Defining the unit of analysis (PARCs)



2.1 Defining the unit of analysis

The purpose of portfolio segmentation is to ensure that PSAs consider the specific context of a product, and the value chain and a region (where appropriate).

This increases the relevance and robustness of PSAs, while reducing complexity through the effective grouping of similar activities with similar sustainability performance. Companies may define product-application-region-combinations (PARCs) as defined under 2.4 Regionalization below and use these as the unit of analysis in the PSA.

PARCs group combinations of products, applications and regions for which sustainability performance is similar. A well-defined PARC is a group of products that are homogenous in terms of sustainability performance and, as such, it is not possible to divide them into smaller segments for which sustainability performance differs.

2.2 Aligning PARCs with existing company segmentations

We advise companies to align PARC segmentations with existing segmentations to maximize the relevance of outcomes for internal stakeholders and reduce the efforts required to gather data on PARCs. Companies should follow the recommendations below to ensure they align the PSA segmentation with existing company market segmentations:

1. Companies should base product groups as much as possible on existing product segmentations. Products in a well-defined segmentation will have a similar sustainability profile.
2. Companies should based application groups as much as possible on existing business segments and align them, where possible, with segmentations used by marketing and in financial reporting.
3. Companies may further divide product-application-combinations into different regions when this increases the relevance of the results.

Companies should apply a precautionary principle and separate activities with potentially negative impacts in separate PARCs. They should define the PARCs before starting the PSA, yet the results of the PSA may lead to the grouping or subdivision of PARCs.

2.3 Defining the "reference benchmark scenario"

For several signal categories, companies assess the PARC sustainability performance in comparison with a reference scenario. The reference scenario highly depends on the context of the market in which a company uses the solution.

The definition of the reference scenario follows WBCSD Guidance on avoided emissions, Helping business drive innovations and scale solution toward net zero (March 2023), p. 31-34, for the different cases, including existing and new solutions.

Companies shall ensure they guide this reference scenario definition by the precautionary principle and the required level of ambition, consistently with the purpose of PSA Framework to highlight and address sustainability risks and opportunities. To ensure credibility and avoid over-/under-stating the impact of a solution put in place, the reference scenario should reflect the most likely situation without the given solution based on recognized and well-documented assumptions during the solution's entire lifetime.

In PSA terminology, this reference scenario is called "the reference benchmark scenario". We provide a few commonly used synonyms in the Glossary.

2.4 Regionalization

Companies may further subdivide product-application combinations to bring granularity to the assessment in reflecting the specific context of a specific region.

This "regionalization" can help companies increase the relevance and representativeness of results by reflecting differences in legislative frameworks, alternative solutions available in the market, and differences in relevant ecolabels. Companies shall not apply regionalization just to bypass negative signals found in other regions, as negative signals from other regions often influence the decision-making of stakeholders in the region under assessment. Companies may therefore only apply regionalization applied under strict conditions.

Companies should use regionalization for classification if a PARC:

- → Demonstrates superior sustainability performance compared to the reference benchmark scenario in one region, and not in other regions;
- → Has a sustainability risk compared to the reference benchmark scenario, in one region and not in other regions.

Companies should not use regionalization for classification if, for example:

- → Global regulation is applicable or expected;
- → It violates global corporate rules.

Companies shall therefore only apply regionalization for sustainability signal categories marked in green in Figure 5 (see Step III for more information on the signal categories).

When applying regionalization, companies shall check whether identified risks in another region could impact the region they are assessing.

For instance, if another region bans a product in an application by multiple players, the risk may also apply in the region a company is assessing.

The PSA Framework does not allow regionalization for globally applicable regulations, such as the Montreal Protocol, for example.

2.5 Sizing Product-Application -Region-Combinations (PARCs)

The size of a PARC is based on the external sales[4] of a company in the specified application in the year of reporting and, if not possible, as recently as possible.

Companies shall align the revenues used to size PARCs with financial and environmental reporting, such as International Financial Reporting Standards (IFRS), Generally Accepted Accounting Principles (GAAP). In some cases, information on actual product end-use may be lacking, such as in the case of highly commoditized chemicals used in a wide range of applications. For such PARCs, companies shall:

- → Define the relative size of applications (% of total) using credible market reports from authoritative bodies;
- → Quantify the size of the PARC by multiplying the relative application size with actual company product sales to derive PARC size;
- → Start defining PARCs with the largest applications – they will continue defining applications using the previous two steps until PARC size becomes too small; they shall explain the minimum size threshold (if applied) and the rationale for its level in the PSA report;
- → Start sizing the largest applications and continue defining applications until PARCs become too small to meet a company's materiality thresholds; they may group all PARCs that together do not meet the materiality threshold together in one PARC; they should not group sensitive applications, as identified during the high-level screening, even when below the minimum size threshold.

[4] This means excluding intercompany sales.

STEP III:
Detecting market signals

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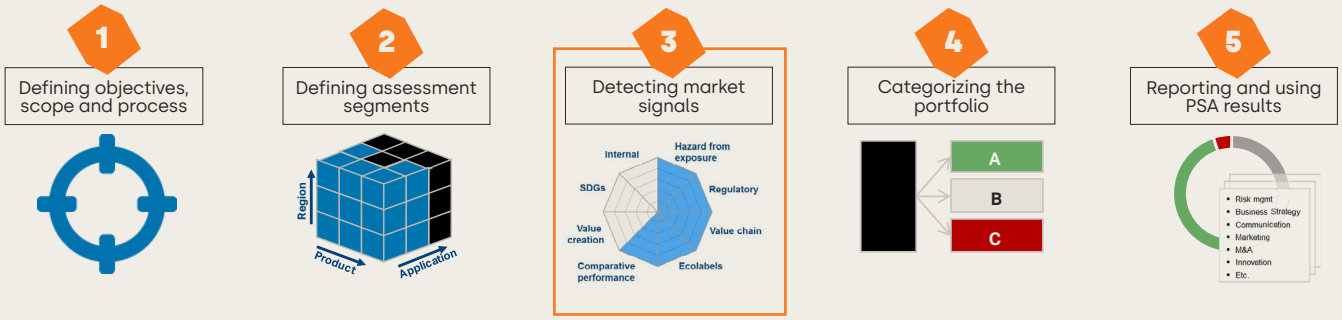
03. STEP III: *Detecting market signals*



3.1 Scope of market signals

Having defined the unit of analysis – the PARCs – companies proceed to scan for "signals" on the sustainability performance for the respective PARC. A signal is a fact-based assessment of material sustainability attributes and actions performed and documented internally. In addition, companies may assess some signals based on external stakeholder actions. These can include legislation, purchasing decisions and ecolabel requirements, among others.

Companies identify signals based on available public information and stakeholder dialogues. Key stakeholders may include: customers, other value chain companies, governments, ecolabels, and industry associations.

Figure 5 lists the eight signal categories identified for the PSA Framework. The table indicates the signal categories where regionalization is possible and the adjustments required to apply the PSA Framework to an innovation project.

Companies shall consider all following four elements in the assessment scope:

A. Environmental, social and economic impacts

Assessment scope implies that:

→ The scope includes environmental impacts, as defined by planetary boundaries.[5]

→ The PSA Framework fully includes social indicators. For more information on potentially relevant social metrics, please refer to documents such as:

- WBCSD 2019 Social & Human Capital Protocol (2019);
- WBCSD Social Life Cycle Metrics for Chemical Products (2016);
- UN Sustainable Development Goals.

→ Financial sustainability is an important consideration. To this end, companies may also include financial measures used to ensure reinvestment economics (internal rate of return (IRR), profit margin, etc.). However, financial consideration alone cannot make a sustainable PARC.

B. Fact-based signals on stakeholder action

→ Companies have to base signals on facts and supported by evidence. Companies shall consider an identified sustainability signal to be material if it is:

- Significant – they expect the signal to lead to changed behavior/actions by relevant stakeholders; and
- Measurable – the signal is based on a factual observation from a credible source.

C. Absolute and relative performance criteria

→ Absolute performance assessments compare PARC characteristics with the requirements and objectives of the relevant stakeholders in the value chains.

→ Relative performance assessments compare PARC performance with the performance of reference benchmark scenario in the scope of the PARC.

Appendix II details the signal categories and whether the performance criteria is absolute or relative.

[5] Stockholm Resilience Centre, Stockholm University (n.d.). Planetary boundaries.

D. **The full life cycle of the product**

- → The assessment considers impacts from all relevant stages within the full product life cycle, from cradle to cradle, considering that in a circular economy materials could potentially circle back into the system until no other material functionality is possible due to the constraints imposed by physical and chemicals laws;
- → Assessment of the materiality and evaluation of circularity[6] for the PARC;
- → Level of granularity/depth of analysis may differ across dimensions of the PARC and the value chains.

3.2 Additional observations on market signals

Companies shall apply a cautionary, robust and transparent approach when identifying sustainability signals, which means:

- → Identified signals on sustainability performance shall be fact-based and supported by robust, independent quality control.
- → Companies shall clearly define materiality thresholds in the methodology. Typically, companies consider a sustainability signal to be material if they expect the identified facts to lead relevant stakeholders to change their behavior or actions.
- → Companies may include signals, which are an addition to industry-wide criteria to ensure the methodology remains relevant for them, in view of new market trends. Such additional, company-specific signals may not offset existing negative signals.

The signals described in this section apply to:

- → Activities at any stage of life cycle of the PARC, from cradle to cradle;
- → Signals driven by either the product, any co-products (products used together with the product a company is assessing) or the application during intended use[7] and observed use;[8]

In the specific case where the company uses the product in an application inducing a sustainability concern, even though the product itself does not present a concern, this automatically negatively impacts the categorization of the PARC.

Full environmental and social LCA data requires continuous updates as new insights affect calculations. Companies should use best efforts to capture and update appropriate metrics throughout the product life cycle, including ingredients, co-products and (where used) referenced competing solutions. They can best achieve this by:

- → Starting with information already available within a company;
- → Completing and upgrading this information through additional research on the signals described in this document on a best-effort basis;
- → Following-up on PSA results to determine in what areas data quality needs further improvement.

Signals on environmental and social performance will evolve over time. For instance:

- → Environmental and social impacts considered important in a specific application will change over time (e.g., water use may become a material topic in a particular application);
- → Expected minimum performance levels on indicators may change (e.g., updates to legislation may require companies to reduce exposure levels of a specific substance);
- → The performance of alternative solutions changes as novel solutions emerge and the performance of existing solutions improves.

Companies shall therefore review the assessment of sustainability signals on a:

- → Regular, structured basis (at a minimum every five years) to ensure that the fact base on which the assessment relies is still up-to-date and representative;
- → Ad-hoc basis, whenever any reason exists to believe that the assessment needs updating because of important changes in the market (e.g., new important regulation, industry initiatives, etc.).

[6] In a PSA, circularity refers to material circularity, as per the WBCSD CTI V4.0 Framework definition. See Appendix III for more details.

[7] As described on the product's technical data sheets, for instance.

[8] Including unintended use observed to occur frequently in practice.

3.3. Signal categories

The signals on sustainability performance aim to identify material environmental and social challenges and opportunities related to the PARC. The signal categories aim to represent the perspectives of different stakeholder groups, which are of relevance in the specific applications. Assessing sustainability using the criteria defined by relevant stakeholder groups enables a company to assess its own sustainability performance using a fact-based outside-in view and highlight areas where changes in decision-making are likely to occur because of sustainability-related reasons.

For each of the identified signals, which could imply either perceived sustainability benefits or concerns, companies shall decide on the materiality of the signal for the PARC. Companies shall consider an identified sustainability signal to be material if the signal is:

→ Significant – the company expects the signal to lead to relevant stakeholders changing their behavior or actions; and

→ Measurable – the signal is based on a factual observation from a credible source.

We cannot exhaustively cover the PSA Framework signals as companies may have specific sustainability requirements. The PSA Framework therefore specifies minimum requirements to ensure consistent results.

Companies may use additional requirements that are relevant to the specific company, as defined in Signal Category VIII: Company internal guidelines and objectives.

Companies **shall** consider five categories of signals on sustainability performance:

1. Chemical hazard and exposure associated with a chemical product;
2. Anticipated regulatory developments and global conventions;
3. Sustainability ambitions along the value chain;
4. Recognized ecolabels, sustainability related certification and standards;
5. Environmental and social performance compared to alternative solutions from cradle to cradle.

Companies **should** consider the following three categories of signals on sustainability performance:

1. Sustainable value creation;
2. Contribution to the Sustainable Development Goals;
3. Company internal guidelines and objectives.

Sustainability concerns or opportunities often appear in more than one category, for instance if governments ban a PARC and key players in the value chain ban the PARC and the PARC prohibits players from obtaining a leading ecolabel. As we have designed the methodology to "scan" for material opportunities and risks, the appearance of opportunities/concerns in several signal categories does not constitute a problem.

Figure 5: Guidelines related to the regionalization of PSA methodologies

Signal category		*May companies apply regionalization?*	*Relevance for innovation assessment*
1	Chemical hazard & exposure associated with a chemical product	**NO**	**Shall**
2	Anticipated regulatory developments & global conventions	**NO**	**Shall**
3	Sustainability ambitions in the value chain	**YES**	**Shall**
4	Recognized ecolabels, sustainability-related certification & standards	**YES**	**Should**
5	Environmental & social performance compared to alternative solutions considering cradle-to-cradle	**YES**	**Shall**
6	Economic value creation vs the use of natural capital	**YES**	**May**
7	Contribution to the Sustainable Development Goals	**YES**	**May**
8	Company internal guidelines & objectives	**NO**	**May**

STEP IV:
Categorizing the portfolio

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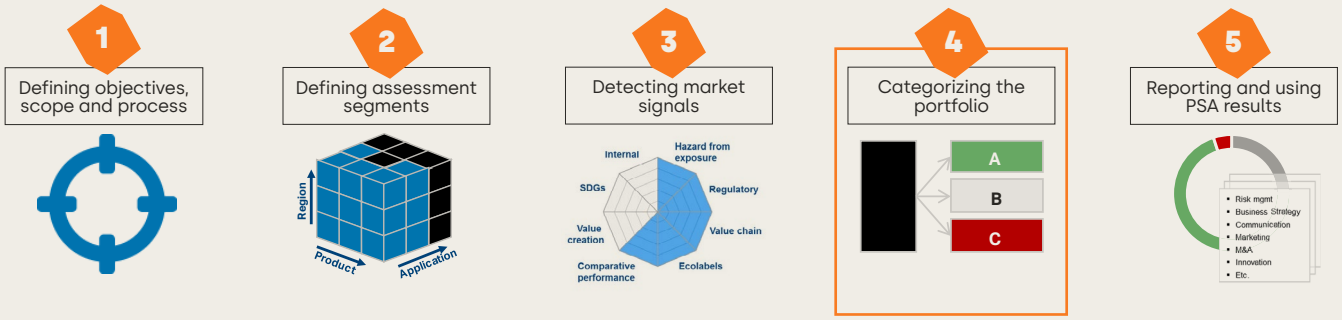
04. STEP IV:
Categorizing the portfolio



4.1 PSA performance categories

Following the identification of sustainability signals, companies shall evaluate all material signals identified and categorize PARCs based on the overall sustainability performance. The categorization of PARCs enables companies to aggregate results and evaluate performance at the portfolio level.

When categorizing results, companies shall make use of at least three performance categories. Companies may select the most appropriate colors, company-specific category names (e.g., accelerator, aligned, etc.) but shall reference them to the following categories in this PSA Framework to avoid confusion:

1. PARCs contributing to a more sustainable world;
2. Neutral PARCs;
3. PARCs with a material sustainability concern.

Best practices use five categories, as defined in Figure 6.

4.2 Categorization principles

The next step describes how the identified signals lead to the categorization of a PARC. The precautionary principle9 guides the PARC categorization: a company shall only recognize the sustainability benefits when the contribution of the PARC is substantial, extensive or fundamental (see Figure 7).

We have adapted this from International Council of Chemical Associations (ICCA)-WBCSD guidance on addressing the avoided emissions challenge and extended it here to all other sustainability-related impacts. Companies need to translate this conceptually from the greenhouse gas emissions context into the PSA Framework context.

Figure 6: Definition of five sustainability performance categories

PARC has one or more strong sustainability-related benefits (no material sustainability challenges identified)	A ++
PARC has one or more sustainability-related benefits (no material sustainability challenges identified)	A +
PARC has neither sustainability-related benefits nor risks	B
PARC has one or more sustainability-related challenges: material business risks or concerns exist	C -
PARC has strong sustainability-related challenges	C --

[9] As described for greenhouse gas emissions in the ICCA-WBCSD Addressing the Avoided Emissions Challenge guidance published in 2013 and extended here to all other sustainability-related impacts.

Figure 7: Guidance on the significance of the contribution

Significance of the contribution	*Relationship between chemical product and end-use solution*
Fundamental	The product* is the key component that enables the GHG emission avoiding effect of the solution.
Extensive	The product is part of the key component and its properties and functions are essential for enabling the GHG emission avoiding effect of the solution.
Substantial	The product does not contribute directly to the avoided GHG emissions but the company cannot substitute it easily without changing the GHG emission avoiding effect of the solution.
Minor	The product does not contribute directly to the avoided GHG emissions but the company uses it in the manufacturing process of a fundamentally or extensively contributing product.
Too small to communicate	The company can substitute the product without changing the GHG avoiding effect of the solution.

*The product means the PARC in the context of PSA.
Based on International Council of Chemical Associations (ICCA)-WBCSD (2017). Avoiding Greenhouse Gas Emissions: The Essential Role of Chemicals.

Table 1: Summary overview of the signal categories

Signal categories	C--	C-	B	A+	A+ +
1 Chemical hazard and exposure associated with a material	A safe intended or observed use of the PARC in its downstream use(s)/ application(s) cannot be demonstrated because of a material risk from priority 1 substances with human exposure or emission in the environment.	A safe intended or observed use of the PARC in its downstream use(s)/ application(s) cannot be demonstrated because of a material risk from priority 2 substances with human exposure or emission in the environment.	Neither positive nor negative signals were identified	Actively eliminates a material risk from priority 2 substances	Actively eliminates a material risk from priority 1 substances
2 Anticipated regulatory developments and global conventions trends	Contains substance(s) included in the priority 1 substance list and the listing is relevant for the application and region under assessment in the foreseeable future.	Contains substance(s) included in the priority 2 substance list and the listing is relevant for the application and region under assessment in the foreseeable future.		Supports customers to – Deliver on today's sustainability ambitions and global conventions OR – Actively substitutes substances listed under "weak negative signals"	Supports customers to implement future sustainability ambitions, regulations and global conventions OR actively substitutes substances listed under "strong negative signals"
3 Sustainability ambitions along the value chain	Is banned/restricted by at least two relevant opinion leaders or large market players or one association	Is banned/restricted by one opinion leaders or large market player		– Actively substitutes a "weak negative solution" – Delivers on top sustainability commitments of top players and industry without having top performance	– Actively substitutes a "strong negative" solution – Delivers on top sustainability commitments in the industry served – Is regarded as a top performing solution regarding respective sustainability indicator
4 Recognized ecolabels, sustainability related certification and standards	Prevents customers from obtaining standard ecolabels and certificates	Prevents customers from obtaining leading ecolabels and certificates		Enables customers to obtain standard ecolabel(s) and certificate(s)	Enables customers to obtain leading ecolabel(s) and certificate(s)
5 Environmental and social performance compared to alternative solutions considering cradle to cradle	Is among bottom sustainability performers on key sustainability indicators	Has below the reference benchmark scenario sustainability performance (yet not a bottom performer)		Provides better sustainability performance than the reference benchmark scenario	Is among the best-in-class solutions in the market in terms of sustainability performance
6 Sustainable value creation	Value of environmental and societal impacts substantially exceeds economic value	Value of environmental and societal impacts exceeds economic value		Economic value exceeds the value of environmental and societal impacts	Economic value substantially exceeds value of environmental and societal impacts
7 Sustainable Development Goals	Provides strong negative contribution to the SDGs	Provides significant negative contribution to the SDGs		Provides significant positive contribution to the SDGs	Provides fundamental positive contribution to the SDGs
8 Company internal guidelines & objectives	Does not comply with company minimum requirements/standards	Company aims to reduce consumption or use of PARC		Not applicable	Not applicable

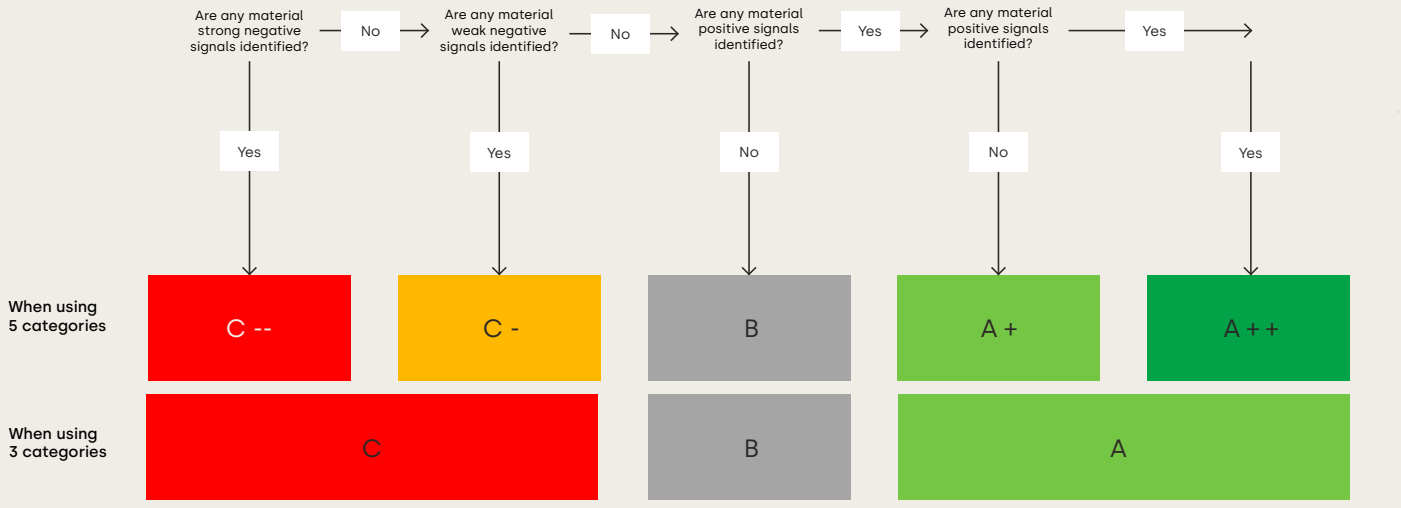
4.3 Weighting and trade-off

Companies may further subdivide Companies shall not balance or offset material sustainability-related concerns and negative signals with sustainability benefits (positive signals), which means that:

- → If the PSA identifies one or more strong negative signals, indicating that the PARC does not fulfill important minimum requirements in the application, companies shall directly allocate it to the most negative performance category **(C - -)**.
- → If it identifies a weak negative signal, indicating the identification of material concerns or risks, companies shall directly allocate the PARC to the **C–** category.
- → Companies should confirm whether a weak negative signal is indeed material in the application in view of the overall, weighted environmental and social performance of the PARC. It is material when it results in changing buying behavior or actions by relevant stakeholders in the respective PARC.
  - – If an identified weak negative signal is not material, the signal should not influence PARC categorization. However, companies should keep track of such weak signals and review at regular intervals to establish whether the status of these signals has changed.
- → A PARC is **A+** or **A++** only if it meets all material sustainability requirements and companies identifies no material negative signal.
- → Companies may acknowledge positive signals only if the precautionary principle10 described in Figure 8 applies: they shall recognize sustainability benefits when the contribution of the PARC is substantial, extensive or fundamental.
- → Companies shall transparently document and report the reasoning applied to categorize PARCs.

The following decision tree illustrates the guidance below.

Figure 8: Decision tree

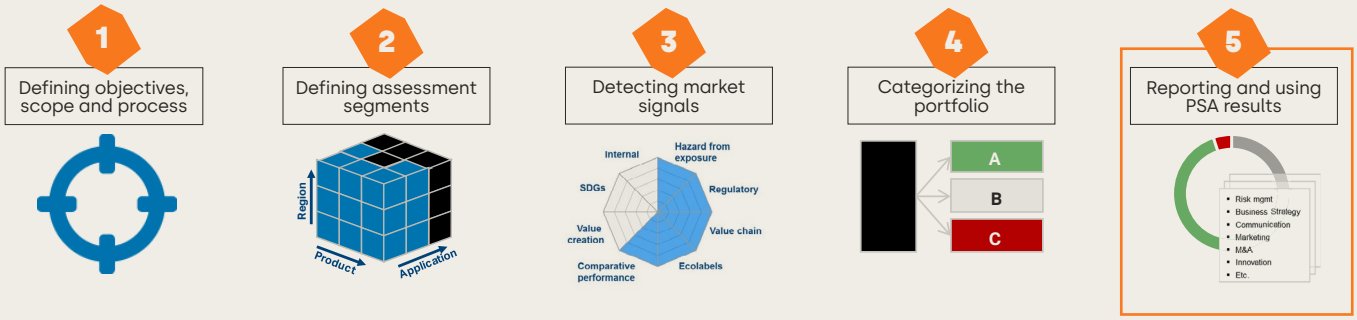


[10] As described for greenhouse gas emission in the ICCA-WBCSD Addressing the Avoided Emissions Challenge guidance published in 2013 and extended here to all other sustainability-related impacts.

STEP V:
Using and reporting PSA results

05.

05. STEP V:
Using and reporting PSA results



5.1 Internal use of PSA results

As previously indicated, participating companies experienced in using the methodology employ PSAs in their strategic decision-making processes.

Companies should read any guidelines related to internal use as recommendation and best-practices to support them in making optimal use of PSA results.

For internal use related to risk and opportunity identification and for internal strategy development, companies may:

- → Expand the number of assessment categories from the minimum three to five to ensure greater granularity;
- → Develop risk mitigation or management plans for negative signals identified during PSAs;
- → Group sustainability signals identified in separate product-application-combinations to create a more comprehensive plan targeting a challenge or benefits that could impact several PARCs (e.g., one action plan related to hazardous substances with material risk or related to healthy food/beverage products or social benefits);
- → Develop a holistic approach to improve performance across the portfolio;
- → Develop plans to capitalize on the positive sustainability indicators identified during the assessment and promote sustainable development along the value chain;
- → Integrate the sustainability perspective in relevant business processes and functions, such as strategy or risk management, so that they logically integrate insights from a PSA in these processes and decision-making;
- → Continue to evaluate improvement potential in products that already have positive sustainability performance as reference benchmark scenarios may need to change over time.

5.2 External reporting of PSA results

There are four levels of PSA reporting, as displayed in Figure 9. When reporting results externally, companies shall provide full transparency in their reporting on:

- → The company methodology used to assess sustainability performance;
- → The scope of assessment, including a summary of excluded activities and rationale for exclusion;
- → The overall assessment results at least for the three categories (positive, neutral and negative);
- → The processes used to conduct the assessment;
- → The assurance process, including steps taken to assure the quality, accuracy and representativeness of results, and assurance results.

In addition, company reporting should ensure consistency between different PARC reports and at the portfolio level:

- → Companies shall not report individual products as part of their product portfolio with a sustainability advantage if they have internally assessed the product to have a neutral or material negative contribution to sustainability;
- → The current PSA Framework does not enable comparative assertion versus other companies' portfolios or individual products.

It is for companies to decide its best course of action to upgrade the overall performance of the product portfolio. The PSA Framework does not prescribe this.

Figure 9: Four levels of PSA reporting

When reporting in conformance with the PSA Framework (level 1), companies:

Shall

- → Only indicate they conducted the PSA in line with the WBCSD PSA Framework if it meets all mandatory requirements at the PSA Framework level;
- → Report on selection of options contained in the methodology, for example, what optional signal categories they took into account;
- → Report transparently that they carried out PARC categorization according to the tradeoff guidance (Step IV/ part III, weighting and trade off: no offsetting of negative signals with positive ones);
- → Not apply any criteria in conflict with guidelines that lead to more positive outcomes.

Should

- → Regularly check for the latest version of all guidelines, regulations, market requirements, etc.

May

- → Apply company-specific criteria that lead to more conservative outcomes;
- → Expand the number of sustainability performance categories (meaning beyond A, B, C) to ensure that the appropriate categorization and management of PARCs according to company strategy.

When reporting on targets related to portfolio coverage (level 2), companies:

Shall

- → Report on coverage using revenues to weight the share of portfolio covered;
- → Report the scope of revenue covered by the PSA assessment;
- → Explain rationale for scope selection;
- → Communicate the target that set;
- → Report progress versus targets;
- → Disclose the part of their business excluded and the rationale for doing so.

Should

→ Report on progress compared to previous years;

→ Explain the roadmap for target coverage and when it reaches intermediate milestones (e.g., 80% milestone).

May

→ Apply company-specific criteria that lead to more conservative outcomes;

→ Expand the number of sustainability performance categories (meaning beyond A, B, C) to ensure that the appropriate categorization and management of PARCs according to company strategy.

When reporting on the share of the portfolio in each of the PSA performance categories (level 3), companies:

Shall

→ Apply (internal or external) assurance and report on assurance processes followed;

→ Use at least three categories (positive, neutral, negative) to report on the sustainability performance of the portfolio, although we recommend the use of five categories and to report on the positive (A) and negative categories (C);

→ Cross-reference a company's definitions for performance categories with definitions provided in this document;

→ Report on all three or five performance categories (selective reporting on one category only is not permitted);

→ Not use PSA outcomes for comparative assertions compared to companies' portfolios or individual products, as the PSA Framework does not enable this.

Should

→ Report on additional performance measures and targets that support sustainable portfolio steering.

May

→ Choose to report on three categories (A, B, C) or five categories (A++, A+, B, C-, C- -) or more if they can translated these back to the three or five categories indicated in this methodology.

When reporting on targets related to the shifting of the portfolio towards specific PSA performance categories (level 4), companies:

Shall

→ Communicate the target that set;

→ Report progress on targets;

→ Explain how they have integrated the PSA into key business processes decision-making.

Should

→ Set targets to increase the A categories and to reduce the C categories (where appropriate);

→ Aim to further improve in positive categories.

May

→ Set targets for only one of the categories;

→ Comment on the ambition level over time (meaning why they set the target at 25%, for example);

→ Provide case examples of how the PSA has influenced decision-making.

Appendices

Appendix I.
Relationship with existing guidance documents

The PSA Framework builds on internationally accepted life-cycle assessment (LCA) standards and guidelines on LCA and carbon footprinting and is therefore not a stand-alone document. Use of the terms "shall", "should" and "may" conforms to International Organization for Standardization and the International Electrotechnical Commission (ISO/IEC) directives (2011). Figure 10 shows how the framework builds on existing guidance documents and standards. In addition, it provides specific guidance for chemicals.

Figure 10: How the PSA Framework builds on existing documents and standards

- → Pathfinder Framework version 2.0 (Partnership for Carbon Transparency (PACT), powered by WBCSD, 2023)
- → ISO 14040:2006 (Environmental management – Life cycle assessment – Principles and framework, ISO, 2006)
- → ISO 14044:2006 (Environmental management – Life cycle assessment – Requirements and guidelines, ISO, 2006)
- → ISO 14067:2018 (Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification, ISO, 2018)
- → The Greenhouse Gas Protocol standard and guidance for scopes 1, 2, and 3 (World Resources Institute (WRI), WBCSD)
- → The EU Product Environmental Footprint (PEF) methodology (European Commission, 2021) and Recommendation on the use of environmental footprint methods (European Commission, 2021)
- → The Social & Human Capital Protocol (Capitals Coalition, 2019)

Appendix II.
Signal categories

Definition of signal categories

The Signal Category definitions are applicable for both existing portfolio assessment and innovation projects. When an adjustment is needed in the specific case of a PSA applied to innovation, additional guidance is added in the relevant categories. Consistent with the framework, the scope is cradle to cradle wherever possible.

Signal Category I

Chemical hazard and exposure associated with a material

Scope: The assessment shall identify material risks arising from a product considering its application (i.e., current or foreseeable future use). The assessment should cover downstream applications (i.e., after it has been sold to customers) for as long as the product maintains its original chemical forms, thus having equivalent hazardous properties. The term "chemical product" in the context of the assessment covers a single substance, a mixture of multiple substances or a functional material resulting from a reaction of multiple substances. Relevant to the assessment are – in addition to the main components – additives, impurities or reaction residuals above concentration limits relevant to the application. In addition, new scientific findings on the product's behavior, e.g., degradation, along its life cycle, may require a reassessment based on those new insights.

In practice: Companies shall evaluate chemical hazard and exposure from using the chemical product in downstream applications. The chemical industry methodology follows a risk-based approach, ensuring that the consideration of both the hazard level and the risk from exposure. The methodology strongly encourages companies to use all evidence available for the preparation of Priority 1 and 2 lists (see below), which may require a reprioritization of substances should new information become available.[11]

At a minimum, companies shall:

- → Regularly review the latest standards to maintain the applied criteria and thresholds in line with current developments in toxicology and ecotoxicology. As a guiding indicator, companies should use the hazard classification of substances, which is the result of a thorough toxicological assessment process, to identify focus areas for the assessment under Signal Category I.
- → Develop a list of Priority 1 substances, which should at least[12] include substances classified[13] in a harmonized way:
  - Globally Harmonized System (GHS) cat. 1A/1B carcinogenic, mutagenic, reprotoxic (CMRs) (H340, H350, H360, H362);
  - Substances determined as very persistent and very bio-accumulative (vPVB) or persistent, bio-accumulative, and toxic (PBT) in the environment according to the Classification, Labelling and Packaging (CLP) Regulation;
  - Substances determined as very persistent and very mobile (vPvM) or persistent, mobile, and toxic (PMT) in the environment according to the CLP Regulation;
  - Endocrine disruptors cat. 1 according to the CLP Regulation.

[11] Companies should assess new products entering the market developed using the PSA in innovation method according to the stricter PSA in innovation logic (see Appendix IV).

[12] Note: This is a minimum list. Companies may add additional substances, such as from further regulation materials, to a company's business and/or move substances from Priority 2 to Priority 1 (though not the other way around).

[13] Substances classified in accordance with the Classification, Labelling and Packaging (CLP) Regulation already anticipating future hazard classes: persistent, bioaccumulative, toxic (PBT), very persistent, very bioaccumulative (vPvB), persistent, mobile, toxic (PMT), very persistent, very mobile (vPvM) and endocrine disruption (ED).

→ Develop a list of Priority 2 substances, which should at least[14] include substances classified[15] in a harmonized way:
  – GHS cat. 2 carcinogenic, mutagenic, reprotoxic (CMR) (H341, H351, H361);
  – GHS cat. 1 respiratory sensitizer (H334);
  – GHS ozone depleting substances (H420);
  – GHS cat. 1A/1B skin sensitizer (H317);
  – GHS cat. 1/2 specific target organ toxic (single exposure) (H370/H371);
  – GHS cat. 1/2 specific target organ toxic (repeated exposure) (H372/H373);
  – Endocrine disruption cat. 2 according to the CLP Regulation;
  – GHS cat. 1/2 chronic aquatic toxic (H410/H411).

Optionally, companies:

→ **Should** develop a list of Priority 1 substances, which should at least include substances classified as:
  – International Agency for Research on Cancer (IARC) group 1 and 2A carcinogens and/or National Toxicology Program (NTP) known human carcinogens and reasonably suspected human carcinogens.

→ **May** categorize PARCs containing, to the best of a company's knowledge, **Priority 1** substances: <0.1% weight-for-weight of the assessing company's final product, with a weak negative signal, if a safe intended or observed use cannot be demonstrated.

→ **Should** develop a list of **Priority 2** substances which should at least include substances categorized in a harmonized way:
  – International Agency for Research on Cancer (IARC) group 2B carcinogens;
  – GHS cat. 1 acute aquatic toxic (H400);
  – GHS cat. 1/2 acute toxic (dermal, oral, inhalation) (H310/H300/H330);
  – GHS cat. 3/4 acute toxic (dermal, oral, inhalation) (H311/H312/H301/H302/H331/H332);
  – GHS cat. 3/4 chronic aquatic toxic (H412/H413).

→ **May** consider other safety and health risks related to the use of the product in the application.

Companies shall apply the following criteria to determine whether a material risk could result from an observed use of a chemical product in its application:

→ The hazardous substance (as per categories previously described) represents:16
  – For Priority 1 substances: ≥ 0.1% weight-for-weight of the assessing company's final product;
  – For Priority 2 substances: ≥ CLP classification limits in % weight-for-weight of the assessing company's final product.

→ AND human exposure to the substance or environmental release of the substance is likely during the downstream applications of the product and as a consequence, could result in adverse effects.

The focus of the assessment must be on the potential of exposure and not based on the sorting of applications into use cases (for example, consumer, professional and industrial uses). However, use cases can be a helpful first step for the assessment. Aspects to consider when assessing the potential of unsafe exposure or unsafe release into the environment from gate to cradle along the observed use should include:

→ Actual concentration of priority substance in the different steps of the downstream applications;

→ Ways of handling the product as part of the application;

→ Ways of potential release in the environment as part of the application;

[14] Note: This is a minimum list. Companies may add additional substances, such as from further regulation materials, to a company's business and/or move substances from Priority 2 to Priority 1 (though not the other way around).

[15] Substances classified in accordance with the CLP Regulation already anticipating future hazard classes PBT, vPvB, PMT, vPvM and ED.

[16] The threshold limits presented here follow the values stated herein. Otherwise, limits to apply follow the Globally Harmonized System (GHS).

→ Production conditions, where applicable (e.g., industrial settings);

→ Access to product safety information like safety data sheets (SDS);

→ Ability and likeliness to follow safety instructions provided with the product;

→ Standard of workplace safety;

→ Effectiveness and convenience of protective equipment;

→ Settings for waste collection or treatment;

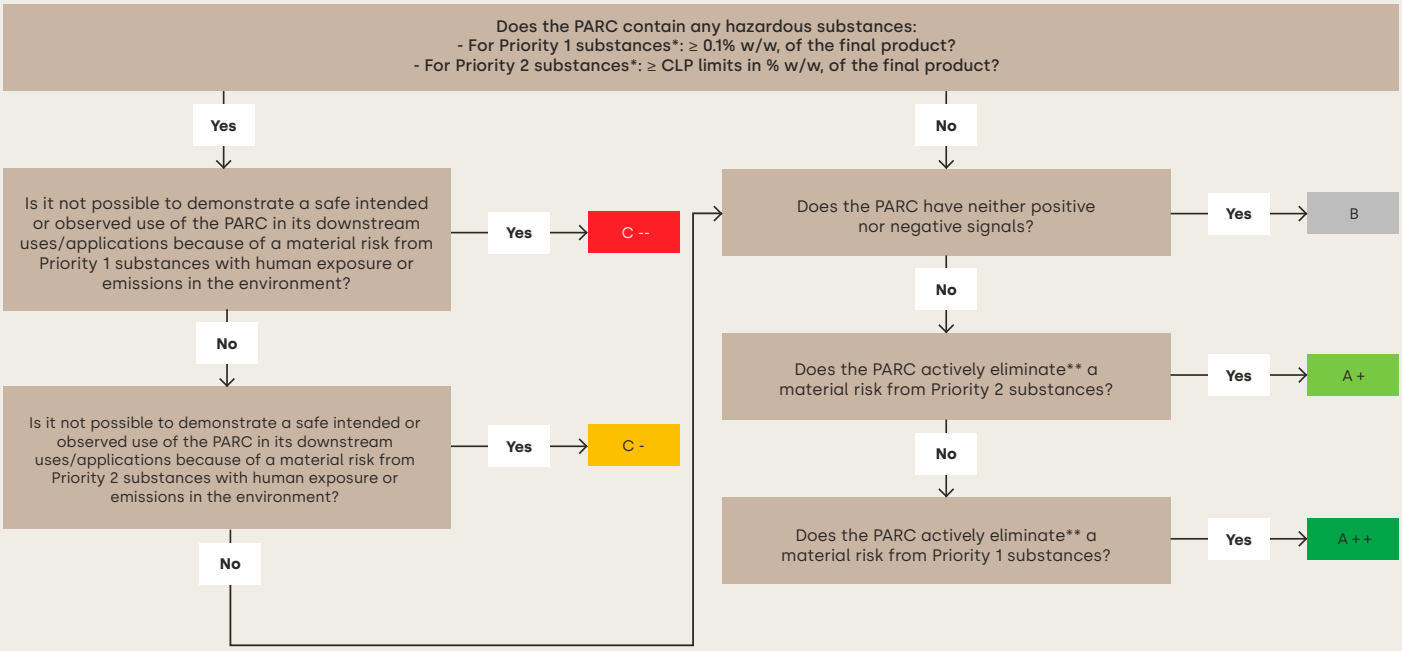
→ Potential exposure of consumers.

Companies may also consider further aspects in efforts to identify risks relevant to the use of the product in the application under the assessment.

Signal Category I decision tree

The following decision tree provides guidance on how to conduct the assessment for Signal Category I following the minimum requirements as stated above for chemical hazard and exposure from cradle to cradle. We do not represent extensions, described as optional for Priority 1 and 2 lists, here.

Figure 11: Signal Category I decision tree for existing portfolio



* Substances from main product, additives and impurities.
** "Actively eliminate" implies that the (i)PARC is an emerging solution, meaning that substitution is effectively ongoing and superior to the reference benchmark scenario. When substitution is completed, a benefit may disappear with the next assessment cycle as the (i)PARC will become the reference benchmark scenario. Companies should be aware and consider potential hazard data gaps or uncertainty in the existing data when assigning a positive rating to minimize the potential for regrettable substitutes.

Modifications when applying PSA to the innovation process

In practice: In principle, companies shall assess the most severe and most relevant hazards as soon as possible, using the scientific methods available. They could base methods for early-stage assessments on new approach methodologies (NAMs) and include, for example, in silico approaches (prediction with quantitative structure–activity relationship (Q)SAR or read-across), in vitro methods, integrated approaches to testing and assessment (IATA), adverse outcome pathways (AOPs), in vivo methods and others, and a combination thereof. Ideally, approaches are based on validated methods.

We adopted the mandatory ("shall") Priority 1 and 2 lists for the innovation assessment to reflect the ambitions of the European Commission for "Safe and Sustainable by Design"[17] chemicals and materials going along with the Chemicals Strategy for Sustainability and respective regulatory changes. For all other details use Signal Category 1 as stated above.

At a minimum, companies:

→ **Shall** develop a list of **Priority 1** substances, which should at least[18] include substances classified[19] in a harmonized way:

- See list earlier on in this section, **including** the following additions moved up from list of Priority 2 substances in the main document:
  - o GHS cat. 1 respiratory sensitizer (H334).
  - o GHS cat. 1 specific target organ toxic (repeated exposure) (H372).
  - o GHS ozone depleting substances (H420).

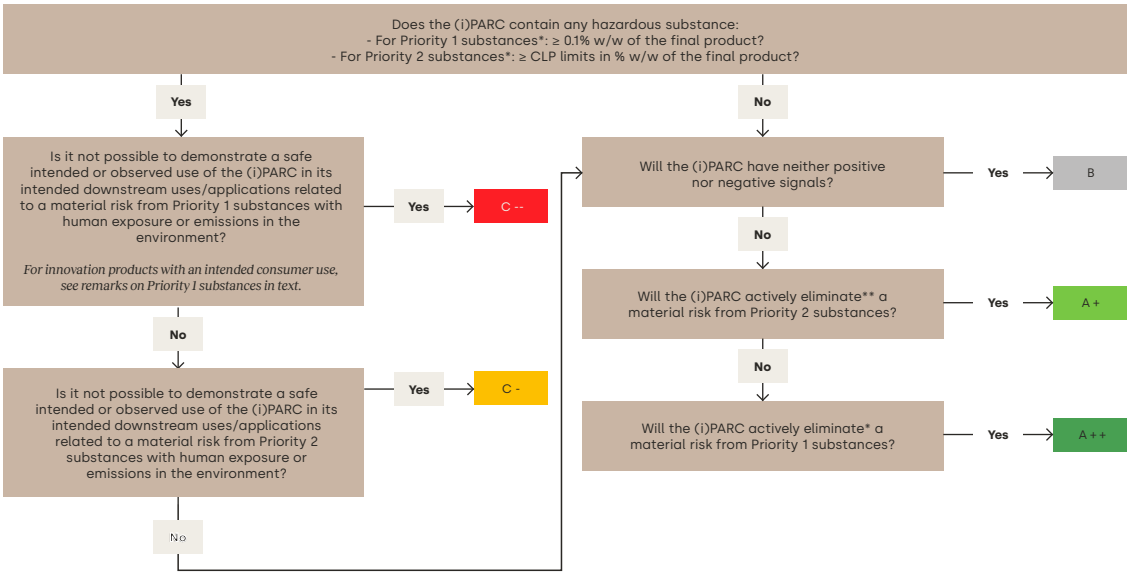
→ Shall develop a list of **Priority 2 substances**, which **should** at least[20] include substances classified[21] in a harmonized way:

- GHS cat. 2 CMRs (H341, H351, H361).
- GHS cat. 1A/1B skin sensitizer (H317).
- GHS cat. 1/2 specific target organ toxic (single exposure) (H370/H371).
- GHS cat. 2 specific target organ toxic (repeated exposure) (H373).
- Endocrine disruption cat. 2 according to the CLP Regulation.
- GHS cat. 1/2 chronic aquatic toxic (H410/H411).

We describe the criteria to determine whether a material risk would result from an observed use of a chemical product in its application above. In the specific case of an intended consumer use, the presence of Priority 1 substances shall strongly signal the innovator to review and try to find an alternative solution wherever possible.

The following decision tree provides guidance on how to conduct the assessment for Signal Category 1 in innovation following the minimum requirements as stated above for chemical hazard and exposure across the life cycle. We do not represent extensions, described as optional for Priority 1 and 2 lists, here.

Figure 12: Signal Category I decision tree adjusted for an innovation project



Signal Category II

Anticipated regulatory developments and global conventions

Scope: Signal Category II considers regulatory changes based on existing – also application-specific – regulatory frameworks, global conventions and regional developments for which experts expect material consequences and which are relevant for the application in question. For a holistic review of regulatory early warning indicators, we recommend the assessment cover all relevant raw materials and process chemicals used in the respective chemical product as far as insights are available. The anticipated developments should, at a minimum, consider impacts materializing within the next five years.

In practice: Companies **shall** regularly evaluate announcements by regulatory bodies and lists considered to be "early warning indicators" for upcoming legislation in a respective application and region. Companies should consider the relevant regulatory classification of substances and thresholds to determine the materiality of the regulatory risk and hence the assessment under Signal Category II.

Companies **shall** develop a list of **Priority 1** substances that should **at least**[22] include substances from announced regulation within existing regulatory frameworks covering:

→ Banned or restricted substances, in an opinion-leading country of relevance with a clear sunset date, including but not limited to:

- US 40 Code of Federal Regulations (CFR) Part 751 – Regulation of Certain Chemical Substances and Mixtures;
- REACH authorization list (Annex XIV);
- Ban of a substance identified under REACH restrictions (Annex XVII);
- Relevant Organisation for Economic Co-operation and Development (OECD) countries, which should include at least European Union, North America, China and Japan.
- Laws, regulations, bans/restrictions of business relevance for a company.

Globally relevant conventions, including at least:

- Substances causing damage to the ozone layer as listed in the Montreal protocol;
- Persistent Organic Pollutants (POPs), as identified under the Stockholm Convention;
- Substances subject to Prior Informed Consent (PIC) under the Rotterdam Convention;
- Mercury-related products and processes, and control measures, as identified under the Minamata Convention.

Companies **shall** develop a list of **Priority 2** substances, which should **at least**[23] include substances that are candidates for stricter regulations by authoritative bodies. Authoritative **candidate lists**, indicating the possibility of evaluation for future regulation, including at least:

→ Substances of very high concern, as identified under REACH regulation (candidate list) or similar lists in other countries;

→ Substances on the U.S. EPA Toxic Substances Control Act (TSCA) Work Plan for Chemical Assessments: 2014 Update.

Companies should also consider lists of (optional):

→ Other lists considered to be early warning indicator, such as the EU registry of Substances of Very High Concern (SVHC) intentions or the EU registry of restriction intentions and Pool 0 substances from Restriction Road Map under EU COM Chemicals Strategy for Sustainability (CSS);

→ Other relevant "opinion leading" countries (e.g., BRICS) and relevant U.S. states, such as California proposition 65 and ED List 1, administered by the Danish Environmental Protection Agency;

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[17] European Commission (2022). JRC Publications Repository. Safe and sustainable by design chemicals and materials - Framework for the definition of criteria and evaluation procedure for chemicals and materials. Retrieved from: https://publications.jrc.ec.europa.eu/repository/handle/JRC128591.

[18] Note: This is a minimum list. Companies may add additional substances, such as from further regulation material to a company's business and/or move substances from Priority 2 to Priority 1 (though not the other way around).

[19] Substances classified in accordance with the CLP Regulation already anticipating future hazard classes PBT, vPvB, PMT, vPvM and ED.

[20] Note: This is a minimum list. Companies may add additional substances, such as from further regulation materials, to a company's business and/or move substances from Priority 2 to Priority 1 (though not the other way around).

[21] Substances classified in accordance with the CLP Regulation already anticipating future hazard classes PBT, vPvB, PMT, vPvM and ED.

[22] Note: This is a minimum list. Companies may add additional substances and/or move substances from Priority 2 to Priority 1 (though not the other way around).

[23] Note: This is a minimum list. Companies may add additional substances and/or move substances from Priority 2 to Priority 1 (though not the other way around).

→ Other countries/states representing significant share of PARC demand or use;

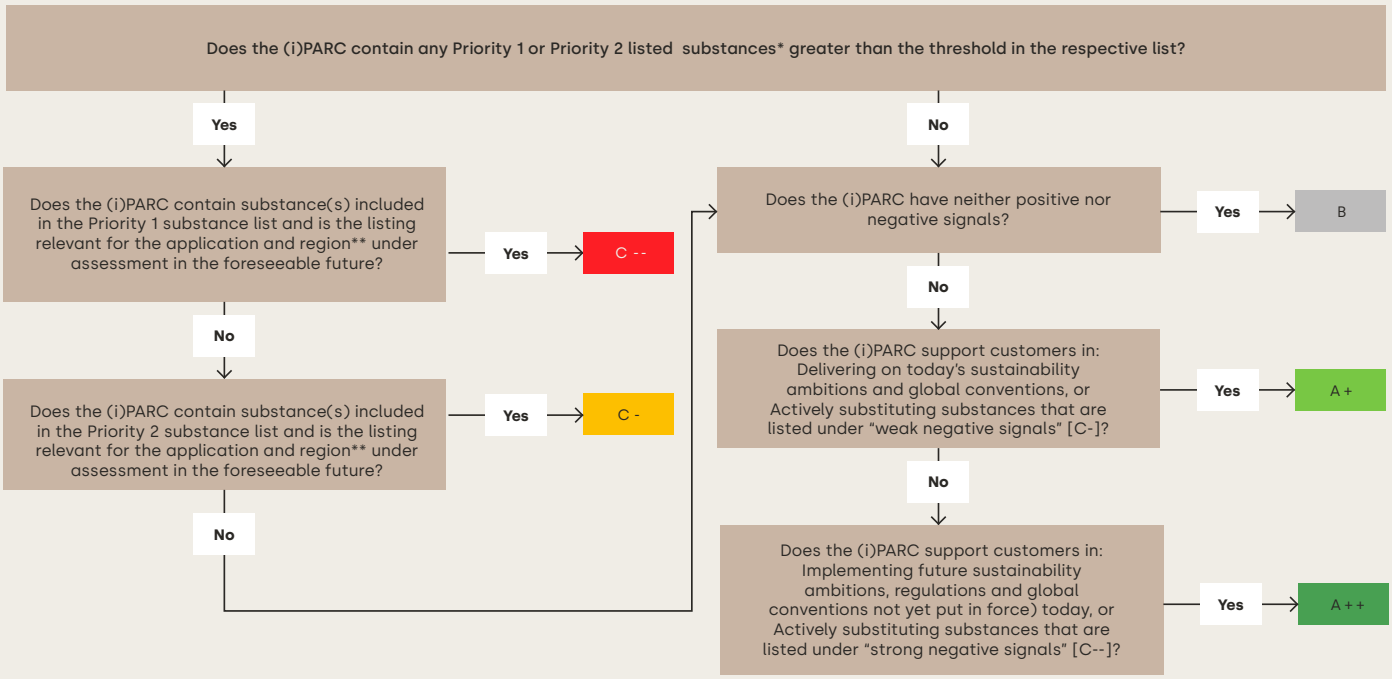
→ Pool 1 and 2 substances from Restriction Road Map under EU COM CSS;

→ Customer industry specific legal requirements (e.g., 1223/2009 EU Cosmetics regulation).

Signal Category II decision tree

The following decision tree provides guidance on how to conduct the assessment for Signal Category II – anticipated regulatory developments & global conventions:

Figure 13: Signal Category II decision tree



When applying PSA to the innovation process, apply Signal Category II as described above.

Signal Category III

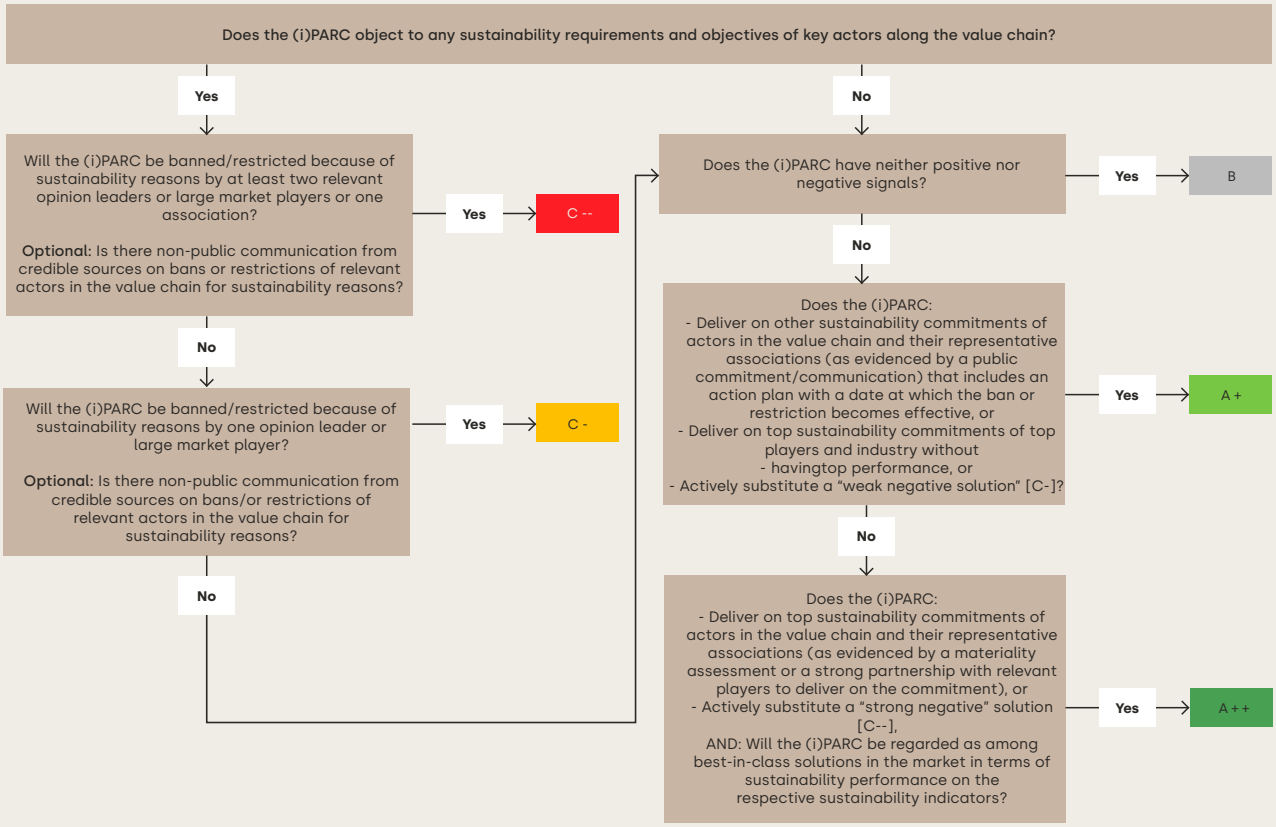
Sustainability ambitions along the value chain

Companies shall evaluate how a PARC performs on sustainability requirements and objectives of relevant actors in the value chain.

For that purpose, companies shall do the following.

1. **Analyze sustainability requirements and objectives of key actors in the respective application and region. At a minimum, companies shall assess the requirements and objectives of:**
   - Opinion leaders, which may include organizations whose opinion is expected to lead market players to change their behavior or actions (e.g., early warning indicator lists that are relevant in the respective value chain, such as the Substitute it Now! (SIN) list, intergovernmental science panels (e.g., Intergovernmental Panel on Climate Change (IPCC), Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)), international research organizations (e.g., World Resources Institute (WRI));
   - Large players in application or value chain, which may include relevant direct and intermediate, potential customers, relevant brand owners and retailers, end-customers or consumers, associations or alliances, suppliers and supplier associations.
2. **Define**
   - Top sustainability commitments of key actors in the value chain and/or their representative associations (as evidenced by a materiality assessment, or a strong partnership by relevant players to deliver on the commitment);
   - Other secondary sustainability commitments of actors in the value chain and/or their representative associations as evidenced by a commitment made in public communication which includes an action plan with explicit date.
3. **Assess the implications of the above sustainability commitments for specific products and applications, such as:**
   - What products are banned/restricted because of sustainability reasons?
   - What products are promoted because of their contribution to sustainability requirements and objectives?
   - How to prevent the commercialization of products forbidden in one region in other regions as a result of less restrictive sustainability product regulation?

Figure 14: Signal Category III decision tree



When applying PSA to the innovation process, companies shall apply Signal Category III as described above.

Signal Category IV

Recognized ecolabels, sustainability-related certification and standards

Companies shall:

→ Identify requirements for relevant ecolabels and sustainability-related certification in the application considered;

→ Evaluate the objectives of these ecolabels and certifications.

In practice, companies:

→ Shall at a minimum consider ecolabels and certificates that are leading and accepted indicators on sustainability performance in the value chain, as defined by the materiality analysis;

→ Should define what a relevant ecolabel is; if there is no relevant ecolabel/certificate, there is no signal.

May also consider:

→ Ecolabels that are nice to have and that signal superior sustainability performance;

→ Other relevant ecolabels to be identified per application and region; examples are available at ecolabelindex.com.

Table 2: Signal categorization (applicable for existing portfolio and innovation projects)

Strong positive	The (i)PARC enables customers to obtain ecolabels and certificate that are leading indicators of sustainability performance in the value chain (e.g., for which market penetration is <20%, meaning strong differentiating performance
Weak positive	The (i)PARC provides enables customers to obtain ecolabels and certificates that are leading indicators on sustainability performance in the value chain (e.g., for which market penetration is <50%)
Neutral	The (i)PARC has neither positive nor weak signals
Weak negative	The (i)PARC prevents customers from receiving ecolabels and certificates that are leading indicators on sustainability performance in the value chain (e.g., for which market penetration is >50%)
Strong negative	Not applicable

When applying PSA to the innovation process,
companies should apply Signal Category IV as described above.

Signal Category V

Environmental and social performance compared to alternative solutions considering cradle to cradle

Companies **shall** evaluate how the PARC performs on sustainability signals along the life cycle when compared to alternative solutions.

At a minimum, companies **shall** consider:

→ Any relevant signal along the full life cycle of a PARC, applying life cycle thinking from cradle to grave;

→ Guidance relative to LCA applicable to other industries and LCA for the chemical sector as listed in Appendix I;

→ WBCSD social metrics minimum requirements (as per Appendix I);

→ The materiality of circularity for the PARC (see Appendix III, phase 1).

Companies **may** consider doing LCAs where relevant.

In addition, companies **should** consider the building blocks for sustainability performance:

→ Limit the impact of the climate crisis;

→ Restore nature;

→ Tackle inequality;

→ Contribution to a circular economy.[24]

Companies may also consider:

→ Other sustainability-related signals:

- Excluded are: profitability, price, volume, growth;
- Included are: helping to increase access to or penetration of solutions that improve environmental or social performance (e.g., availability of high-quality food).

Table 3: Relevant references to support assessment of the building blocs for sustainable performance projects)

	Examples of actions to consider	*References*
Limit the impact of the climate crisis	– Decarbonization – Mitigation and adaptation – Energy transition – Carbon removal and sequestration	Intergovernmental Panel on Climate Change (IPPC) (2023). AR6 Synthesis Report: Climate Change 2023
Restore nature	Consider addressing drivers for nature changes: – Land/water/sea-use change, resource use – Pollution – Climate change – Invasive species	Drivers for change defined by the Taskforce on Nature-related Financial Disclosures (TNFD) IPBES (2019). Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. E. S. Brondizio, J. Settele, S. Díaz, and H
Tackle inequality	10 high level actions, Fig. 7 and 8 on pages 28 and 29 of the Business Commission to Tackle Inequality (BCTI) report on tackling inequality	Business Commission to Tackle Inequality (BCTI) (2023). Tackling inequality: An agenda for business action

[24] See Appendix III, phase 2 or 3 for specific guidance on assessing the material circularity of a PARC.

Typical process to follow:

1. Start with full list of relevant criteria and identify that are material for the assessed PARC;
2. Select, if relevant, additional sustainability performance criteria for the application (e.g., energy, water, social, material circularity, etc.);
3. Consider relevant alternatives for raw materials and competing solutions, which shall include the reference benchmark scenario;
4. Estimate overall performance[25] versus reference benchmark scenario on the relevant sustainability criteria, in the relevant life-cycle step(s) of the product;
5. Optional materiality test: Is the benefit direct and significant so that customer will opt for your solution instead of a competing solution?[26]

Signal categorization

Table 4: Signal categorization for category V

Strong positive	The (i)PARC provides a direct, significant and measurable improvement over relevant competing solutions in the market: AND: The contribution of the chemical product to the (i)PARC is fundamental or extensive* AND: The (i)PARC is among the best-in-class solutions in the market in terms of sustainability performance
Weak positive	The (i)PARC provides a direct, significant and measurable improvement over the reference benchmark scenario (or over next–best alternative if you are the leading solution**) over the life cycle AND: The contribution of the chemical product to the (i)PARC is fundamental, extensive or substantial
Neutral	The (i)PARC has neither positive nor weak signals
Weak negative	The (i)PARC has direct, significant and measurable disadvantages in terms of environmental and social performance (over the life cycle when compared to the reference benchmark scenario, performance is below average, yet not a bottom performer)
Strong negative	The (i)PARC has direct, significant, and measurable disadvantages in terms of environmental and social performance over the life cycle and the (i)PARC is among bottom sustainability performers on key sustainability indicators

* As defined in the avoided emissions guidance, International Council of Chemical Associations (ICCA)-WBCSD (2017). Avoiding Greenhouse Gas Emissions: The Essential Role of Chemicals

** Only if the next-best alternative has a significant market share (otherwise a company cannot claim the positive signal).

When applying PSA to the innovation process,
companies should apply Signal Category V as described above.

[25] Performance reference benchmark scenario to be based on credible external evidence. Determining overall performance may require weighting, which a company can do using quantitative measures (e.g., monetization, weights) or qualitative expert judgments.

[26] Meaning companies may disregard sustainability benefits for which they identified no demand in the market.

Signal Category VI

Sustainable value creation

Companies should compare the PARC's economic value creation with environmental and societal impacts.

Stakeholders scrutinize the chemical industry, like other energy-intensive industries such as cement and steel, because of the industry's perceived environmental impacts. Given the importance of the topic for key stakeholders and because companies will potentially internalize such environmental impacts (externalities) following "the polluter pays" principle, it is important to measure whether the PARC's cradle-to-gate footprint entails an opportunity or risk for a company.

This recommended – not mandatory – section focuses on assessing the PARC's economic value creation compared to the impacts of its cradle-to-gate operations on the environment.

In addition to assessing environmental impacts, companies may also include social impacts with the cradle-to-gate value chain in the assessment.

Typical process to follow

Companies generally apply slightly different approaches to evaluate signals in this category, although the overall reasoning is often consistent. Best-practice approaches include the following:

- → Calculate the environmental footprint (LCA from cradle to exit gate of the factory) for one unit of product (typically by weight);
- → Weight the different environmental impacts (for example – but not necessarily – through the monetization of environmental impacts);
- → Compare value withdrawn of environmental and societal impacts by the PARC's cradle-to-gate operations with PARC revenues; companies typically either:
  - – Subtract environmental damage created from economic revenues;
  - – Divide economic revenues by monetized environmental damage created.

Table 5: Signal categorization for category VI

Strong positive	Economic value substantially exceeds value of environmental and societal impacts Example metrics: – Value of economic value is more than double the value of natural resources withdrawn, or – Selling price is twice the monetized manufacturing footprint per kg product
Weak positive	Economic value exceeds the value of environmental and societal impacts Example metrics: – Economic value is more than the value of natural resources withdrawn, or – Selling price is greater than the monetized manufacturing footprint per kg product
Neutral	Economic value is (about) equal to withdrawn natural and human capital
Weak negative	Value of environmental and societal impacts exceeds economic value Example metrics: – Value of natural resources withdrawn is more than the PARC's economic value, or – Monetized manufacturing footprint per kg product is greater than the selling price
Strong negative	Value of environmental and societal impacts substantially exceeds economic value Example metrics: – Value of natural resources withdrawn is more than double the PARC's economic value, or – Monetized manufacturing footprint per kg product is greater than twice the selling price

Signal Category VII

Contribution to the Sustainable Development Goals

Companies should evaluate the contribution of PARCs to the delivery of the UN Sustainable Development Goals (SDGs). In addition, the guidance in this section provides a standardized approach to cross-referencing identified sustainability-related benefits to the SDGs, enabling companies to report how its solutions contribute to the SDGs.

What are the SDGs?

On 25 September 2015, UN Member States adopted a set of 17 goals to end poverty, protect the planet, and ensure prosperity for all as part of a new sustainable development agenda.[27]

Typical process to follow

Companies should assess which of the SDGs are material for the PARC due to both its positive and negative contributions to the achieving of these goals. They should do such materiality assessments by reviewing the targets and indicators. They should perform signal categorization for each selected material SDG in relation to the reference benchmark scenario.

Table 6: Signal categorization for the Sustainable Development Goals (SDGs) (category VII)

Strong positive	The product is the key component (contribution is "fundamental") that contributes to the achievement of the material UN SDGs
Weak positive	The product is part of the key component (contribution is "extensive") and its properties and functions are essential to the achievement of the material UN SDGs.
Neutral	The PARC has neither positive nor negative signals
Weak negative	The product is part of the key component and its impacts on the value chain, properties and functions entail a significant negative contribution to achieving the material UN Sustainable Development Goals (SDGs)
Strong negative	The product is the key component and its impacts on the value chain, properties and functions entail a strong negative contribution to achieving the material UN SDG(s)

[27] Learn more about the SDGs at https://sdgs.un.org/goals.

Signal Category VIII

Company internal guidelines and objectives

Companies should evaluate compliance with internal sustainability-related guidelines. This section is optional and there are no minimum requirements. In line with the cautionary approach, the application of internal guidelines shall only lead to more negative evaluations and therefore cannot lead to the identification of positive signals.

Examples of internal guidelines and objectives applied by companies include sustainability-related corporate guidelines on:

→ Company code of conduct;

→ Product safety;

→ Sustainability objectives and strategy (e.g., on GHG emissions, energy efficiency, etc.);

→ Minimum profitability levels;

→ No-go applications;

→ Supplier sustainability requirements.

Table 7: Signal categorization for category VIII

Strong positive	Not applicable
Weak positive	Not applicable
Neutral	The PARC has neither positive nor negative signals
Weak negative	The company aims to reduce the consumption or use of the PARC
Strong negative	The PARC does not comply with company minimum requirements/standards

Appendix III.
Recommendations for assessing the circularity of a PARC

The relevance of the circular economy for a PSA

This appendix aims to augment the established life cycle metrics to better evaluate the circularity of PARCs.

WBCSD's Product and Materials pathway as part of its Vision 2050 is a system where companies optimize resource use to meet society's needs while allowing the systems that provide resources to regenerate. The circular economy is at the heart of the required system transformation to decarbonize, halt global biodiversity loss and advance equity.

A company evaluates the PARC's contribution to the circular economy through its material circularity. This appendix guides the evaluation of the PARC circularity and proposes a categorization that then aggregates with the other signals evaluated in Signal Category V.

PARC material circularity guiding principles and definitions

Consistent with the approach described in PSA Step I, part III, Implementation pathway, the guiding principles described below encourage the progressive assessment of material circularity where relevant and improving granularity over time. Therefore, the PARC material circularity assessment takes place in 3 phases:

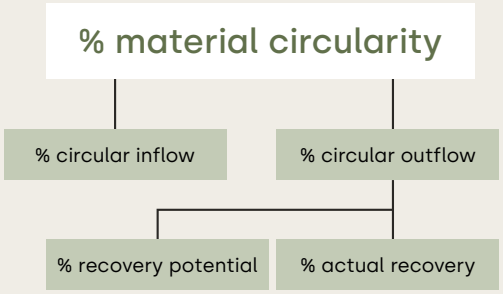
→ Phase 1: Materiality of circularity across the full life cycle of the PARC (shall);

→ Phase 2: Qualitative evaluation of PARC circularity (should);

→ Phase 3: Quantification of PARC circularity (may).

We use the approach and definitions established in the Circular Transition Indicators (CTI) Framework V4.0.28
We present a simplified overview of the elements below.

Figure 15: Elements of material circularity for the PARC as per CTI V4.0 methodology



Definitions from the CTI Framework to adapt to the PARC scope	
Inflow	***Outflow***
Inflow measures how companies source materials. This includes : 1) Virgin (materials not used before), 2) Non-virgin (materials used in a previous cycle) 3) Renewable (sustainably grown and managed bio-based resources). In the context of PSA, this means resources that enter a company, including materials, parts or products (depending on a company's position within the supply chain).	Outflow measures how much of a company's outflow is recovered and reintroduced into the economy. This means that the company needs to design the product to allow for the technical or biological recovery of materials and the infrastructure needs to be present for those recovery strategies.

[28] WBCSD (2023). Circular Transition Indicators V4.0. Material circularity defined Figure 3, p 16.

Within material circularity, in the context of chemicals, companies may consider the use of the mass balance approach.

There is to date no CTI definition describing how products may enable the circularity of other products in the value chain systems in which they participate. WBCSD chemical company members acknowledge the need to develop a harmonized and endorsed definition before it can accurately inform portfolio steering.

Evaluating PARC circularity

Integrating circularity into the PSA aims to encourage the embedding of circularity more holistically and systematically into company processes to identify risks and opportunities. For each of the phases considered, the following guidance applies to the evaluation of PARC material circularity.

Phase 1: Materiality of circularity across the full life cycle of the PARC (identify signals)

What to do

Companies **shall** assess how the PARC influences circularity along the value chain, from cradle to cradle, if circularity is material for the PARC, and identify the associated signals.

For this purpose, the following guiding principles offer a non-exhaustive list to consider in substantiating the materiality of circularity to the PARC, by taking into account the following dimensions:

- → **Inflow** – e.g., feedstock sources, resource intensity, resource constraints associated with ingredients to make the PARC;
- → **Outflow** – e.g., end of life of the PARC;
- → PARC's impact on circularity of the value chain;
- → Stakeholder expectations relative to circularity, which may comprise value chain ambitions, regulations, relevant NGOs, a company's own ambitions.

Once a company has identified circularity-related signals, it should move to phase 2 and complete a circularity assessment.

How to evaluate

For each of the circularity dimensions cited above, companies shall ask: *"Does the PARC influence positively or negatively the circularity of the value chain?"* (Y/N)

For each dimension where a company has identified a positive or negative material impact, it should then complete a qualitative or quantitative circularity assessment as described in phase 2 or phase 3.

Phase 2: Qualitative evaluation of PARC circularity

What to do

Companies **should** proceed to a qualitative assessment on the PARC scope, consistent with CTI Framework[29] as guidance.

How to evaluate

Companies **may** use the approach described below for either qualitative or quantitative analyses.

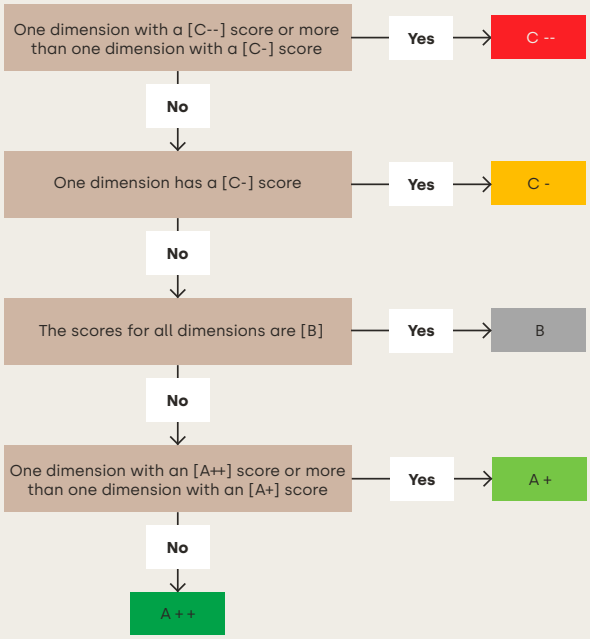
1. To capture the severity of risk and magnitude of contribution, evaluate the PARC's impact on circularity for **each dimension**[30] according to the following criteria:
   - A++ rating: The PARC's circularity performance is substantially above average in this dimension;
   - A+ rating: The PARC's circularity performance is above average in this dimension;
   - B rating: Circularity dimension is not a market signal or the PARC's circularity performance is average in this dimension;
   - C- rating: The PARC's circularity performance is marginally below average in this dimension;
   - C- - rating: The PARC's circularity performance is far below average in this dimension.

[29] WBCSD (2023). Circular Transition Indicators V4.0.

[30] Inflow, outflow, value chain impact, stakeholder expectation

2. To obtain the final **PARC circularity categorization**, it is necessary to do a first aggregation following the decision tree presented in Figure 16. While doing so, companies must provide detailed documentation to ensure the granularity of the outcome.

Figure 16: Decision tree to aggregate the individual circularity dimensions into the final PARC circularity categorization



Note: Companies define dimensions earlier on as inflow, outflow, impact on value chain, stakeholder expectations.

The final PARC circularity categorization is one of the signals to consider when evaluating Signal Category V.

Companies then need to aggregate the PARC circularity categorization with the other signals when evaluating Signal Category V, according to the principles presented in Step IV (Categorizing the portfolio).

[31] Inflow, outflow, value chain impact, stakeholder expectation

Phase 3: Quantification of PARC circularity

What to do

Where relevant, companies **may** proceed to a quantitative assessment on the PARC scope following the quantitative methodology as prescribed in the CTI Framework (see reference above).

How to evaluate

Companies **may** use the approach described below for either qualitative or quantitative analyses.

1. To capture the severity of risk and magnitude of contribution, evaluate the PARC's impact on circularity for each dimension[31] according to the following criteria:
   - A++ rating: The PARC's circularity performance is substantially above average in this dimension;
   - A+ rating: The PARC's circularity performance is above average in this dimension;
   - B rating: Circularity dimension is not a market signal or the PARC's circularity performance is average in this dimension;
   - C- rating: The PARC's circularity performance is marginally below average in this dimension;
   - C- - rating: The PARC's circularity performance is far below average in this dimension.
2. To obtain the final PARC circularity categorization, it is necessary to do a first aggregation, then to follow then the decision tree presented in Figure 17. While doing so, companies must provide detailed documentation to ensure the granularity of the outcome.

The final PARC circularity categorization is one of the signals to consider when evaluating Signal Category V.

Companies then need to aggregate the PARC circularity categorization with the other signals when evaluating Signal Category V, according to the principles presented in Step IV (Categorizing the portfolio).

Note: Companies define dimensions earlier on as inflow, outflow, impact on value chain, stakeholder expectations.

Appendix IV.
PSA for innovation

I. Sustainability in innovation: PSA – A compass to seize new growth opportunities

Innovation is a key business level to foster emergence of sustainable solutions. The PSA Framework applied in this context supports identifying and prioritizing opportunities that contribute to address global sustainability challenges. When applied to innovation projects, companies shall raise safety and sustainability ambitions to ensure the futureproofing of solutions developed, which can be paramount when prioritizing project budgets and funding.

This appendix guides practitioners in integrating the PSA into an exemplary innovation stage gate process. It includes:

→ A description of an exemplary innovation process and its touchpoints with PSA;

→ Design principles to apply at very early stages of the innovation process.

II. A compass for sustainability integration into innovation processes

The section explains an exemplary stage gate process and how to apply the PSA in this context. Figure 18 and Figure 19 summarize it. We provide further details below.

Generally, changing or new requirements arising from customers, value chains, production needs, regulators or others targeting functionality and performance trigger an innovation. Most companies apply their own stage gate process. We describe a typical example here, including its links to the assessment (see as well Figure 18).

Figure 18: An exemplary innovation process and how to apply the PSA in these different stages

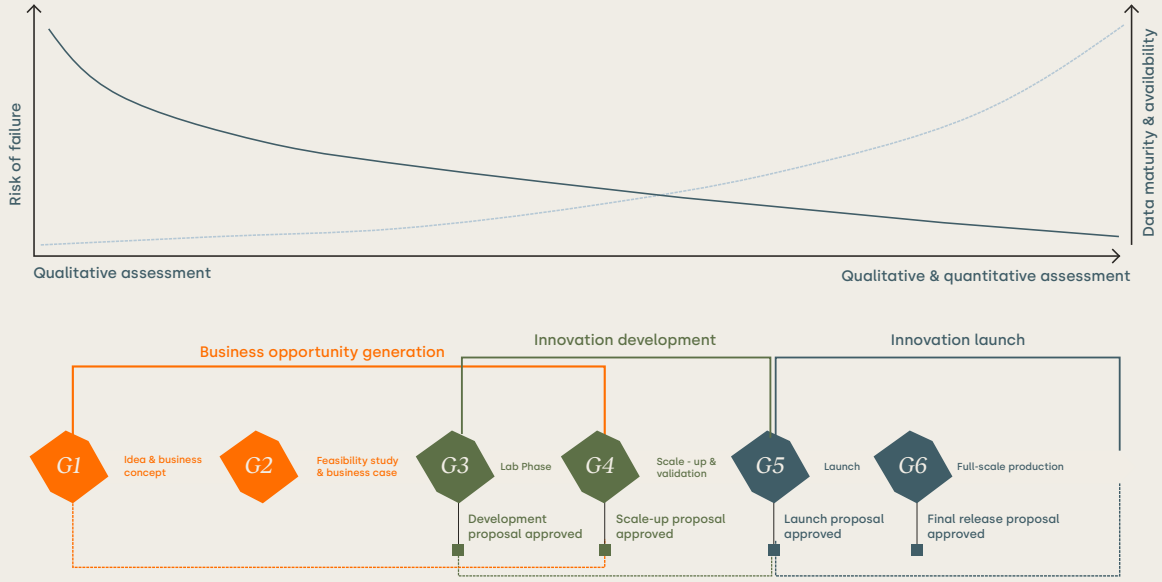
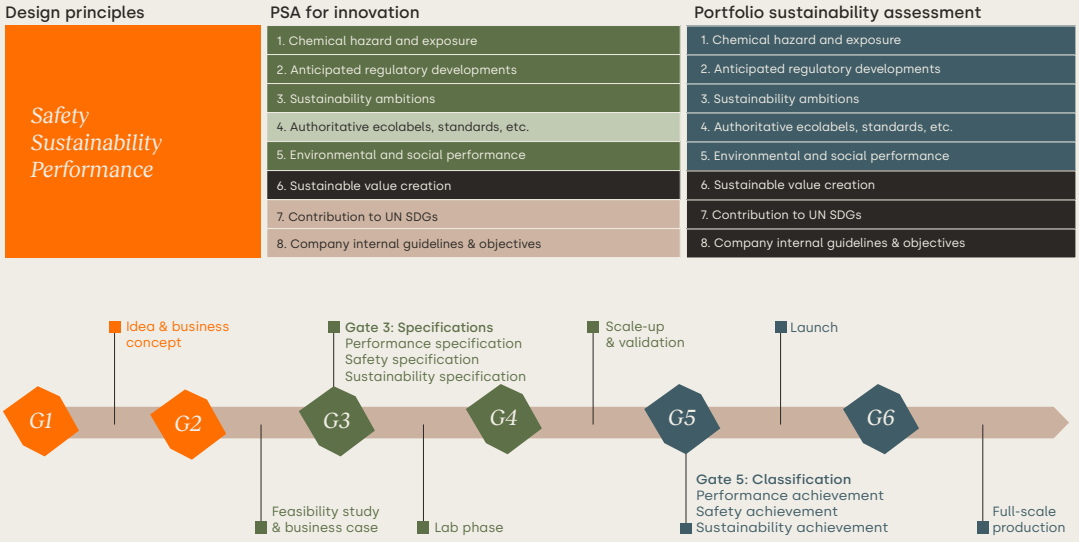


Figure 19: Depiction of main decision points and evaluation approaches recommended depending on the technical readiness level



- Stage A (G1-G2): Kick-off of the innovation. The idea stage follow this, usually including the development of a business concept, where considers potential solutions to the requirements. This is the first time where companies **should** apply design principles (part III below).
- Stage B (G2-G3): Through feasibility studies, companies perform a first consolidation of ideas alongside the development of the business case. Here it **may** use the design principle evaluation to prepare a first approach to the PSA, which it **should** do for Gate 3. Gate 3 marks the decision point – to invest time and resources to actively develop a solution fulfilling (all) the requirements, defined by relevant stakeholders, inside and outside a company. These requirements describe the specifications relevant to the innovation.
- Stage C/D (G3-G4 / G4-G5): During the lab-, scale-up and validation phase, companies screen, refine and, towards the end, reduce the several candidates for the innovation to one or two viable candidates. In these phases, they check relevant requirements repeatedly with the screening and testing methods available, applying a life-cycle thinking approach. The aim is to optimize the innovation in as many aspects as possible and to validate that they meet the specifications. In addition, companies conduct scale-up trials, validating the producibility of an innovation in the processes and volumes foreseen. Companies **may** refine the initial approach to the PSA from G3 during these stages if it generates new relevant information.
- Stage D (G4-G5): G5 is the point to decide on whether to commercialize an innovation. At this technical readiness level, the risk of failure has gone down significantly and the data maturity and availability have improved significantly. Consequently, in stage D – around the launch – there **should** be a first full assessment of an innovation, evaluating the level of achievement against the specifications defined earlier.
- Stage E and beyond (after Gate 5): After a successful launch the project becomes an offering in the portfolio. With that, companies **should** transfer it to one or several PARCs and include it in the portfolio PSA process.

Companies **shall** also iterate the PSA for innovation, considering the latest developments in all signal categories and the different expectations of the innovation stages.

In addition, while the scope and logic of PSA remains the same for innovations, a few adjustments are necessary to accommodate the growing breadth of information available. Figure 19 depicts this.

These adjustments are rooted in:

- **The necessity to anticipate future safety and sustainability requirements for the new solutions:** Signal Category I requires greater ambitions for innovation to foster substitution for hazardous substances where ever alternatives are available (Appendix II, Signal Category I, Modifications when applying a PSA to the innovation process);
- **The data availability and quality during the innovation process:** As the project matures through the different iterations and phases of the innovation process, the availability and the quality of the data evolves from pure qualitative data towards more robust and then quantitative data, enabling a progressively more thorough sustainability assessment. This translates into different requirements for the PSA as the project evolves throughout the different stages, from design principles (Stages A & B) to a high-level congruence with the major requirements for safety, sustainability and performance right before market launch (Stage D).
- **The progressing implementation of sustainability market signals in line with growing data availability:** In the early stage of the innovation process, some market signals are more important than others (see STEP III Detecting Market Signals, Figure 5). Once a company has passed Gate 3, a more concrete innovation plan is available and intensive experiments generate more data and feed into the sustainability assessment. Applying this to the innovation portfolio gradually increases the safety and sustainability profiles of a company's (future) portfolio.
- **A multi-parameter optimization:** This process targets safer and more sustainable products without compromising performance and functionalities. When **needs for arbitration arise**, a company must carefully address them. It is best practice to involve international multi-disciplinary teams to resolve them.

Specifically for companies using or producing chemicals, companies may also consider the following references to do a check and balance exercise:.

- Caldeira, C., Farcal, L., Garmendia Aguirre, I.et al. (2022). Safe and sustainable by design chemicals and materials – Framework for the definition of criteria and evaluation procedure for chemicals and materials. European Commission Joint Research Centre, Publications Office of the European Union.
- Organisation for Economic Co-operation and Development (OECD) (2021). Guidance on Key Considerations for the Identification and Selection of Safer Chemical Alternative. OECD Series on Risk Management, No. 60. Environment, Health and Safety, Environment Directorate, OECD.

III. Design principles for the idea phase

To anchor sustainability thinking in the innovation process and optimize sustainable outcomes, it is of high priority to reflect in a holistic way on the contribution of innovation projects to sustainability at a very early stage.

As every answer starts with asking the right question, companies should consider the design principles as a first direction to guide action. Before applying the PSA Framework, this quick sustainability screening will evaluate the alignment of the Innovation project with sustainability and safety without compromising other aspects, such as functionality and performance requirements. Having those questions in mind from the beginning will help in performing the PSA assessment during the innovation project at a later stage.

Design principles using the questions below

Does the project:

1. Consider hazard and exposure for the anticipated production process(es), use phase and end-of-life to eliminate/ minimize the risk through reduction of hazards and exposure?
2. Consider existing and upcoming regulatory trends?
3. Address the respective market drivers on sustainability?
4. Avoid any additional manufacturing (gate-to-gate) negative impacts on e.g., resource, energy, water use, GHG emissions, water or air pollution, biodiversity?
5. Mitigate risks/challenges on the different related value chains, and rather support social and environmental benefits?
6. Embed or enable circular design?
7. Have an improved environmental and social performance against the existing reference benchmark scenario considering the entire life cycle, from raw material extraction to end of life?
8. Protect basic human rights along the value chain?
9. Align with and support the company's sustainability goals?
10. Spot and mitigate any reputational risk along the value chain/life cycle?

Depending on the alignment with the principles, companies can derive actions for the following innovation activities:

→ In alignment – Build up on this strength: specify, quantify, validate;

→ Not in alignment – Work on this weakness: specify, find solutions, improve;

→ Non-relevance – Keep in mind if relevance shifts;

→ Knowledge gaps – Create more insights: specify, evaluate, act.

As of Gate 3, companies shall use Annex II to run a PSA assessment for an innovation project.

Glossary

Assurance
The quality management process aimed at safeguarding that the inventory results and report are complete, accurate, consistent, transparent, relevant and without material misstatements.

Chemical product
The product sold by the reporting company.

Comparative assertion
A claim regarding the superiority or equivalence of the performance of one product versus a competing product that performs the same function.

Company
In this framework, this is shorthand to refer to the entity developing a PSA, which may include any organization or institution, either public or private, such as businesses, corporations, government agencies, non-profit organizations, assurers and verifiers, universities, etc.

Cradle to cradle
In this framework, refers to expanding the life-cycle boundary of a product from its creation (cradle) to its next life stage where materials cycle back into the system (cradle to cradle) until no further circularity allowance is possible due to physical, chemical, technological and economical constraints.

Cradle-to-gate inventory
A partial life cycle of an intermediate product, from material acquisition through to when the product leaves the reporting company's gate (e.g., immediately following the product's production).

Cradle-to-grave inventory
Environmental and social impacts of a studied product, from material acquisition through to end-of-life.

Downstream
Environmental or social impacts associated with processes that occur in the life cycle of a product subsequent to the processes owned or controlled by the reporting company.

Final product
Goods and services consumed by the end-user in their current form, without further processing, transformation or inclusion in another product. Final products include products consumed by end-consumers and products consumed by businesses in the current form (e.g., capital goods) and products sold to retailers for resale to end consumers (e.g., consumer products).

Innovation
Describes the process of inventing, designing, testing, scaling and launching new or optimized processes, services or goods before they enter the market.

Intermediate products
Goods used as inputs in the production of other goods or services.

Reference benchmark scenario
Used for comparative assessment of the PARC performance. We define this as per the WBCSD Guidance on avoided emissions published in March 2023. This reflects the most likely situation without the given solution. Companies may use synonyms like market standard, next best alternative, baseline, etc.

Materiality
Signals on sustainability performance considered to be material when both of the following aspects apply:

- → Significant – The company expects the signal to lead to changed behavior or actions by relevant stakeholders;
- → Measurable – The signal is based on a factual observation from a credible source.

May
Used in this document to indicate a course of action permissible within the limits of the document (ISO/IEC, 2011).

Shall
Used in this document to indicate requirements companies must strictly follow to conform to the guidelines in this document and from which no deviation is permissible (International Organization for Standardization and the International Electrotechnical Commission (ISO/IEC) directives, 2011).

Should
Used in this document to indicate that among several possibilities one is particularly suitable, without mentioning or excluding others, or that a certain course of action is preferable but not necessarily required, or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited (ISO/IEC, 2011).

Life cycle
Consecutive and interlinked stages of a product system, from raw material acquisition or generation of natural resources to end-of-life.

Life-cycle assessment (LCA)
Compilation and evaluation of inputs, outputs and potential environmental impacts of a product system throughout its life cycle.

Life-cycle stage
A useful categorization of the interconnected steps in a product's life cycle for the purposes of organizing processes, data collection and inventory results.

PARC
(product-application-region-combination)

The unit of analysis for a PSA in the chemical industry methodology for PSAs. When referring to iPARC, this refers to a PARC of an innovation project.

Quality criteria
Guidelines to support companies in developing and applying consistent, high-quality PSA approaches.

Reporting
Presenting data to internal management and external users such as regulators, shareholders, the general public or specific stakeholder groups. External reporting refers to the reporting to external stakeholders.

SDGs
United Nations Sustainable Development Goals[32]

Signal
A fact-based observation on material, sustainability-related actions or commitments of key stakeholders (e.g., legislation, purchasing decisions, ecolabel requirements) that indicate whether or not stakeholders perceive the PARC as contributing to a transition to a more sustainable world. Companies identify signals through the evaluation of the public communication of key stakeholders (e.g., governments, downstream players, ecolabels, industry associations, etc.).

Solution
Any product in its application along the value chain, a chemical product, a material from another industry, a component or a final technology that fulfills the need of the purchaser.

Sustainability goals
Key objectives of respective actors to improve environmental or social performance.

Third-party (external) assurance
Assurance performed by a person(s) from an organization independent of the company performing the PSA process. Internal assurance refers to assurance processes performed by the reporting company itself, without a review by independent external parties.

Value chain
In this framework, refers to all of the upstream and downstream activities associated with the operations of the reporting company, including the use of sold products by consumers and the end-of-life treatment of sold products after consumer use.

Circularity glossary used in the PSA framework

In this PSA Framework, we use circularity and circular economy as synonyms. We have extracted definitions used from the CTI 4.0

Framework. We provide a reminder of the terms and their definitions below.

% material circularity
The weighted average of the % circular inflow and % circular outflow for a given product (group or portfolio), business unit or company.

Circular inflow
Inflow that is:

→ Renewable inflow (see definition) and used at a rate in line with natural cycles of renewability

OR

→ Non-virgin

Circular outflow
Outflow that is:

→ Designed and treated in a manner that ensures products and materials have a full recovery potential and extend their economic lifetime after their technical lifetime

AND

→ Demonstrably recovered

Inflow
Resources that enter the company, including materials, parts or products (depending on a company's position within the supply chain). Not included are water and energy, which are part of the specific water and energy indicators.

Non-virgin inflow
Inflow previously used (secondary), e.g., recycled materials, second-hand products or refurbished parts.

Recovery
The technically feasible and economically viable recovery of nutrients, compounds, materials, parts, components or even products (depending on the organization) at the same level of functional equivalence through reuse, repair, refurbishment, repurposing, remanufacturing, recycling or biodegrading. This excludes energy recovery from waste and any biological cycle waste that does not satisfy all criteria as outlined on p. 45 of CTI v4.0.

Recovery types
The different forms of material recovery, such as (in order of the recirculation loops in the Ellen Macarthur Foundation's Circular Economy System Diagram[33] or butterfly diagram):

→ Reuse

To extend a product's lifetime beyond its intentional designed life span, without changes made to the product or its functionality.

→ Repair

To extend a product's lifetime by restoring it after breakage or tearing, without changes made to the product or its functionality.

→ Refurbish

To extend a product's lifetime by large repair, potentially with replacement of parts, without changes made to the product's functionality.

→ Remanufacture

To disassemble a product to the component level and reassemble (replacing components where necessary) to as-new condition with possible changes made to the functionality of the product.

→ Recycle

To reduce a product back to its material level, thereby allowing the use of those materials in new products.

→ Biodegrade

Microbial (bacteria and fungi) breakdown of organic matter in the presence of oxygen to produce soil with high organic (humus) content.

→ Renewable inflow

Sustainably managed resources, most often demonstrated by internationally recognized certification schemes like the Forest Stewardship Council (FSC), Programme for the Endorsement of Forest Certification (PEFC), Roundtable on Sustainable Palm Oil (RSPO), etc. that, after extraction, return to their previous stock levels by natural growth or replenishment processes at a rate in line with use cycles. Therefore, they are replenished/regrown at a faster rate than harvested/extracted.[34]

Acknowledgements

DISCLAIMER

This report is released in the name of WBCSD. Like other reports, it is the result of collaborative efforts by WBCSD staff and experts from member companies. WBCSD's Circular Chemicals project participants reviewed drafts, ensuring that the document broadly represents the majority of project members' views. It does not mean, however, that every member company of WBCSD agrees with every word. Please note that the data published in the report are as of 31 May 2023.

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WBCSD would like to thank the following companies for providing their insights and collaboration:

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WBCSD would like to thank the following individuals for their contributions to this report:

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About WBCSD

The World Business Council for Sustainable Development (WBCSD) is a global community of over 220 of the world's leading businesses, representing a combined revenue of more than USD $8.5 trillion and 19 million employees. Together, we transform the systems we work in to limit the impact of the climate crisis, restore nature and tackle inequality.

We accelerate value chain transformation across key sectors and reshape the financial system to reward sustainable leadership and action through a lower cost of capital. Through the exchange of best practices, improving performance, accessing education, forming partnerships, and shaping the policy agenda, we drive progress in businesses and sharpen the accountability of their performance.

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