Circular Economy Sustainability Screening: CIRCit Workbook 1

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Circular Economy
Sustainability Screening
A CIRCit Workbook
What are we exploring in this workbook?

Circular Economy is often seen as one of many means to achieving sustainability and the intentions of the practitioner are likely to be inherently sustainable. But is circularity intrinsically sustainable, all on its own? With this workbook, we provide support for the assessment of whether or not your ambitions, strategies and plans for Circular Economy are actually sustainable, seen from an environmental, social and economic perspective. We provide an approach to help you to choose the criteria and related indicators, to enable a sustainability screening of a circular business proposal, product design, maintenance strategy or take-back plan. And we provide a way of supporting the decision-making process for the practitioner to work through, to ensure that we make circular and sustainable decisions.

Circular Economy Sustainability Screening A support for decision-making through the sustainability screening of alternative circular solutions in terms of environmental, social and business potential. e-ISBN: 978-87-7475-601-9


Smart Circular Economy A look at how digitalisation and smart products can play a role in facilitating the transition to a Circular Economy. e-ISBN: 978-87-7475-607-1

Closing the Loop for a Circular Economy An assessment tool and guidelines to support the identification of the best circular strategy for products at end-of-use. e-ISBN: 978-87-7475-609-5

Collaborating and Networking for a Circular Economy An approach to support circular value chain configurations, seeking innovation through collaboration. e-ISBN: 978-87-7475-611-8
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Introduction to Circular Economy

What is Circular Economy?
Circular Economy is a concept, based on the principle of decoupling value creation from resource consumption. The basic idea of Circular Economy is to move away from the so-called linear mindset, where value creation is based on the ‘take-make-use-dispose’ dogma.

Circular Economy has the potential to achieve maximum value by increasing resource productivity, enhancing energy efficiency, lowering resource consumption and decreasing waste. To do this, we should continue to extract value from resources for as long as possible, by extending their productive lifetimes. This means, for example, increasingly enjoying product and service offerings that are not necessarily based on one-time ownership, and not necessarily based on single-lifetime products.

On first thought, many might equate Circular Economy to recycling of old and used products and materials. And indeed, material recirculation is a possibility, whether it be via recycling, cascading or recovering. Alternatively, and more valuable again, one could consider product recirculation, by applying tactics such as upgrade, repair & maintenance, reuse or remanufacturing. Even greater potential could also be achieved, by rethinking whole new ways of generating value, via integrated product/service business approaches, shared-access products, or new service offerings for long life products.
Achieving a Circular Economy requires a fundamental shift in mindset through business model, product design, support of the active product life cycle and closing the product loop, when the user no longer has a need for it. At the core of a Circular Economy lies collaboration, within and across value chains and with different societal stakeholders than we’ve maybe been used to.

And there’s no use being circular, if the outcome is less sustainable than the starting point. Therefore we need to be able to estimate the sustainability benefits and drawbacks of our actions.

For many companies, there will be obvious low-hanging fruits, such as reduction of single-use packaging in the production facility, or making small design changes to the product, to ease its disassembly at end-of-life. But for most, there will be a necessity to re-think the way in which business is done, materials and components are sourced, and new types of solutions are developed and marketed, in order to achieve maximum value and circularity from the resources used.

The good news is that there are increasing numbers of examples, in all types of business sectors and within civil society, in general. Circular Economy is a movement that is currently under rapid development, and the many necessary components to shift our mindset from a linear to a circular economy are increasingly manifesting themselves.

The Circular Strategies Scanner can help you to map which strategy or strategies are already being implemented by your company and to identify opportunities of complementary strategies to maximise the value created for as fewer resources as possible. We will refer to this Scanner throughout the six workbooks.
Introduction to CIRCit

The CIRCit research project was a 3½-year research project, spanning the five Nordic countries, Denmark, Norway, Finland, Iceland and Sweden. Using a number of action research methods, CIRCit’s objective was to support the Nordic industry to discover and implement the opportunities of Circular Economy, through the development, testing and implementation of science-based tools.

The project spanned six main areas, corresponding to the workbooks that you are currently reading, as follows.

Circular Economy Sustainability Screening
This workbook supports decision-making by providing sustainability screening of alternative circular solutions in terms of environmental, social and business potential.

Circular Economy Business Modelling
This workbook supports the creation of circular business models, based on a step-by-step approach, best practice and success cases.

Circular Product Design and Development
This workbook presents an approach for assessing product circularity in the conceptual design stage, plus practical design guidelines to support early product development decisions.

Closing the Loop for a Circular Economy
This workbook helps to evaluate how digitalisation and smart products can play a role in facilitating the transition to a Circular Economy.

Collaborating and Networking for a Circular Economy
This workbook provides an assessment tool and guidelines to support the identification of the best circular strategy for products, taken back at end-of-use.

Smart Circular Economy
This workbook presents an approach to support various circular value chain configurations, seeking innovation through stakeholder collaboration.

How to make the transition
The basic concept of Circular Economy is easy to grasp for many. It is appealing from a business perspective, as it connects good business sense to good environmental stewardship. After all, which business would not like to reduce the consumption of cardboard boxes in internal production shipping, fully utilise its logistics capacity, or make its product easier to produce, maintain and upgrade?

The tricky part for many companies, however, is in knowing which steps to take first. How ready is your customer and the market in general, to embrace circularity and what role can your company play? Are there drivers or barriers to be found in the way in which regulations are composed in your area of operation – and if so, are there ways of exploiting the drivers or removing the barriers? Should we design the product for upgrade, or should we develop a new business for leasing? Should we make a new partnership for materials sourcing, or should we be better at monitoring our product in-use? As with many new phenomena and business trends, it is often easier to admire and envy the existing good case examples than it is to actually get started on the journey within one’s own business.

This workbook is one in a series of six proposed areas to begin the transition to a Circular Economy.
Sustainability Screening of Circular Economy Initiatives

1 Overview

The purpose of this workbook is to provide guidance on how to perform a sustainability screening of Circular Economy initiatives. The process is supported by a step-by-step procedure and a corresponding digital database, which are intended to facilitate discussion about corporate Circular Economy efforts and to guide quantitative performance assessment, with the ultimate goal of assisting decisions towards designing and selecting a more sustainable initiative.

What to expect?
The workbook is intended to show the main process of working with sustainability screening of Circular Economy initiatives. This is achieved by providing explanations of the terminology and key concepts used, hands-on practical examples and references to CIRCit tools, developed to assist sustainability screening.

The main intended outcomes of using the workbook and corresponding tools are:

• Enhanced dialogue about Circular Economy in your corporate context and its intended outcomes
• Identification of key sustainability aspects to be considered for the design of your Circular Economy initiative
• A systematic process of selection of relevant sustainability indicators for your Circular Economy initiative
• Insight into what data is needed to calculate indicators and how to interpret their results
• Understanding of the sustainability implications of a Circular Economy initiative
• Quantitative support of an early identification of improvement opportunities to enhance sustainability performance.

When to use?
Before starting using the tools described in this workbook, it is important to have a clearly defined and detailed Circular Economy initiative. A Circular Economy initiative can be understood as a specific proposal of implementing a Circular Economy strategy or several strategies simultaneously (e.g. refer to...
the CE Strategies Scanner, presented on page 7, with the intention of resolving a problem or improving a specific situation. A detailed Circular Economy initiative should therefore contain information about what exactly needs to be done, why it is important and what is intended to be achieved, and who is involved in its design & implementation.

If you have not yet defined an initiative, check out the other workbooks in this CIRCit series (covering business model innovation, product design & development, smart technologies, closing the loop and value chain configurations). By using the provided tools in these workbooks, you will be able to further define a number of initiatives to make the transition to Circular Economy – and this workbook will then be able to help you in screening their sustainability performance.

Who can this workbook support? This workbook is targeted at the project management teams in manufacturing companies, which are aiming to understand the sustainability performance of Circular Economy initiatives that their company is planning. It is important to bring a multidisciplinary team together, to tackle the Circular Economy initiative at hand, typically consisting of product managers, marketing managers, sales and operations managers, and sustainability managers. Engaging sustainability managers or sustainability ‘stewards’ will greatly facilitate the process of indicator selection and a dialogue about inclusion of significant sustainability aspects relevant not only for the Circular Economy initiative in focus, but also for the organisational context.

Circular Economy initiative detailing (an example)

<table>
<thead>
<tr>
<th>Description</th>
<th>Taking back and recycling our own product into a similar product</th>
</tr>
</thead>
<tbody>
<tr>
<td>What needs to be done?</td>
<td>Rethinking a business model to retain ownership of own product (for customer X in a country Y) Establishing a return system (logistics, warehousing) Understanding recyclability of our product and exploring potential recycling partners</td>
</tr>
<tr>
<td>Why is it important?</td>
<td>To reduce waste generated from our product To reduce virgin material input for our production site</td>
</tr>
<tr>
<td>What is intended to be achieved?</td>
<td>Resource conservation and reduced transport needs for virgin material</td>
</tr>
<tr>
<td>Who is involved?</td>
<td>Business managers, product developers, production engineers, other stakeholders (to be defined later)</td>
</tr>
</tbody>
</table>
Sustainability screening in the context of Circular Economy

Sustainability screening is a process that entails gathering insights on (potential) sustainability performance of a specific initiative, in order to support planning and decision-making in a company, towards sustainability improvements. This process facilitates internal learning about sustainability implications of a specific initiative, rather than simply measuring “direction to target”.

Contribution to sustainable development is primarily aligned with the three main dimensions of sustainability: environmental integrity, social well-being, and economic resilience.

While some aspects only relate to performance on one dimension (for instance, cost aspect for economic performance, emission aspect for environmental, and safety for social), many of the aspects are cross-dimensional, which indicates their implications on several dimensions simultaneously.

Circular Economy can be seen as means towards achieving enhanced sustainability – but this is not always the case. While repairing a product may indeed contribute to resource preservation, how is the energy consumption compared to a brand new product? When focusing on alternative materials, is it more sustainable to have bio-based or recycled materials?

Sustainability screening of Circular Economy initiatives contributes to a better understanding of potential sustainability performance within a Circular Economy context. Taking this perspective into account, the sustainability screening offers a structured support in early design phases by:

1. Indicating environmental, economic and social aspects that are potentially significant for the initiative
2. Providing guidance on selecting relevant indicators to quantify performance on the key aspects
3. Reflecting on the results to support initiative improvements.

2 Motivation
A step-by-step approach for a systematic indicator selection for sustainability screening of Circular Economy initiatives

1. **Define the scope for indicator selection**
   - How will the initiative be described?
   - Are there relevant Circular Economy strategies and business processes?
   - What key questions need to be addressed?

2. **Select relevant key performance indicators**
   - Establish an initial indicator set.
   - Prioritise sustainability aspects.
   - Select suitable indicators.
   - Customise and create new indicators.

3. **Apply final indicator set**
   - Get an overview of data and set up a data collection plan.
   - Calculate indicators and compare alternatives.
   - Use results to support decision making.

**Leading indicators**

Input/output indicators:
- Material cost per unit of product
- Hazardous substances in product
- Noise level at working stations
- Take-back offerings for products, for example

**Lagging indicators**

Outcome/impact indicators:
- Marine eutrophication
- Global warming potential
- Customer retention
- Gross margin, for example

**Focus on leading performance indicators**

Sustainability screening in this work is based on leading performance indicators, which ensure early consideration of potential impacts on the sustainability performance and highlight areas to introduce improvements to.

Leading performance indicators are input/output indicators, used to help planning, designing and improving initiatives in the early design stages. Leading indicators are easier to understand and interpret than lagging indicators, which are mostly used to measure outcomes/impacts.

Major benefits of working with leading indicators include greater measurability of potential impact and the ability to control it through design changes, which are more difficult to do with lagging indicators, despite the increasing certainty of data available for calculations.

In summary, the key benefits of leading performance indicators are:
- Help to structure, summarise and condense complex information
- Induce learning about significant sustainability aspects associated with specific materials, products, processes and operations
- Help to anticipate possible impacts of a certain action and/or initiative, prior to its implementation
- Support early consideration, hence the possibility to adjust and improve the initiative
- Allow comparison of alternative initiatives and highlight potentials for optimisation.

Therefore, sustainability screening based on leading indicators can assist structured and informed sustainability-oriented decision-making in the early stages of planning and designing Circular Economy initiatives.

The workbook supports sustainability screening by assisting selection, customisation and implementation of relevant leading performance indicators. The purpose is to enable industry to perform sustainability screening in a systematic way.

Once a Circular Economy initiative is detailed and the scope is defined (Step 1), four sub-steps are carried out for the selection and customisation of indicators (Step 2). The process of indicator selection and customisation results in a final set of key indicators (Step 3), which can be used to screen the selected Circular Economy initiative according to its economic, environmental and social performance.

The workbook supports sustainability screening by assisting selection, customisation and implementation of relevant leading performance indicators. The purpose is to enable industry to perform sustainability screening in a systematic way.

Therefore, sustainability screening based on leading performance indicators can assist structured and informed sustainability-oriented decision-making in the early stages of planning and designing Circular Economy initiatives.

The workbook supports sustainability screening by assisting selection, customisation and implementation of relevant leading performance indicators. The purpose is to enable industry to perform sustainability screening in a systematic way.
Step 1 - Define the scope for indicator selection

The goal of Step 1 is to further elaborate on a defined Circular Economy initiative, in order to clearly set the scope for indicator selection. By specifying and elaborating your initiative, you create alignment within your team about your Circular Economy initiative intentions, as well as to clarify, who should be engaged in the screening process.

Participants required
A range of experts are often involved in planning and designing a Circular Economy initiative (e.g. board members, marketing & sales coordinators, sustainability strategy & innovation managers, service & operations engineers, managers, product designers and project managers).

Time required
• 15 min to describe the Circular Economy initiative in focus
• 15-30 min to select relevant business processes and Circular Economy strategies.

Circular Economy initiative detailing (an example)

<table>
<thead>
<tr>
<th>Description</th>
<th>Maintenance service for a specific product and subsequent take-back of the used product for internal spare parts retrieval (reuse) and consequent recycling</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is intended to be achieved?</td>
<td>Reduce premature product obsolescence Ensure product parts and materials are reused in the system</td>
</tr>
<tr>
<td>Why is it important?</td>
<td>Capture value embedded in our long-life product</td>
</tr>
<tr>
<td>Rethinking a business model to offer subscription to a monthly maintenance service (for customer X in a country Y)</td>
<td>Establishing a maintenance service system and facilities Complete product disassembly for part reuse and material recycling (incl. understanding of the recyclability of our product and exploring potential recycling partners)</td>
</tr>
<tr>
<td>Identified CE strategies</td>
<td>• Rethink value generation (business model transformation) • Repair and Maintenance • Reuse • Recycle</td>
</tr>
<tr>
<td>Identified business processes</td>
<td>• Business model • After-sales service • End-of-life operations</td>
</tr>
</tbody>
</table>

Describing your Circular Economy initiative and identifying Circular Economy strategies and business processes, relevant for that particular initiative, helps to involve the right people for the process based on the provided example of the Circular Economy initiative.

It is important that the team have knowledge and expertise about the company’s sustainability priorities, specifics of the sector, process and product.

Participants required
A range of experts are often involved in planning and designing a Circular Economy initiative (e.g. board members, marketing & sales coordinators, sustainability strategy & innovation managers, service & operations engineers, managers, product designers and project managers).

Time required
• 15 min to describe the Circular Economy initiative in focus
• 15-30 min to select relevant business processes and Circular Economy strategies.

Step 1.1: Describe your proposed Circular Economy initiative
Circular Economy initiatives can entail several Circular Economy strategies that are to be implemented together. For example, a Circular Economy initiative can be formulated as providing a monthly maintenance service for a specific product and subsequent take back of the used product for internal spare parts retrieval (reuse) and consequent recycling. This is a first overall initiative description, which requires more details to be provided for it, for example, what exactly needs to be done, why it is important and what is intended to be achieved, who is involved in its design and implementation.
To assist characterisation of the details of the selected initiative, the circular economy strategies scanner should be used, so to select only Circular Economy strategies relevant for that particular initiative (identified CE strategies on page 18). Furthermore, it is important to identify what business processes are involved, which helps bringing the right participants in the team. For instance, if the initiative requires changing commercial relationships with your customers and/or partners, business model should be selected.

Following the example, business model has been selected as one of the business processes, as the initiative requires changing commercial relationships with customers, by offering a new type of service (‘identified business processes’, see page 18). Likewise, after-sales service is selected, as the initiative requires changing the way of delivering service to the customer and supporting product in use. In addition, end-of-life operations has been preliminary selected, to understand whether disassembly and recycling is to be carried out internally or externally. Use the checklists available under tab ‘Step 1’ in the digital database to assist yourself in identification of relevant Circular Economy strategies and business processes that are involved in the selected Circular Economy initiative.

To help your team in creating relevant questions, always start by using the umbrella question “What indicators to use to understand sustainability performance when... “, followed by stating a relevant scope.

**Outputs**

- A set of selected relevant business processes and Circular Economy strategies for the particular Circular Economy initiative
- Formulate key questions to guide a meaningful indicator selection in the next step
- Try out different combinations of business processes and Circular Economy strategies
- Engage a multidisciplinary team.

**Step 1.2: Specify relevant Circular Economy strategies and business processes**

A list or overview of the relevant Circular Economy strategies and business processes helps understanding the real scope and effort to design and implement a particular Circular Economy initiative. To continue the process of sustainability screening, it is important to formulate key questions, which would take into consideration a combination of selected Circular Economy strategies and business processes.

Using the example on page 18, a CE strategy Rethink value generation can be combined with a business process business model, and this combination could help to formulate a key question to assist activities in Step 2. A key question would then be “What indicators to use to understand sustainability performance when developing a business model based on subscription scheme?”.

Similarly, more questions may be formulated to help the team see the importance of meaningfully combining Circular Economy strategies and business processes, for instance, the CE strategy Repair and Maintenance can be combined with Reuse and After sales service, supported by a key question “What indicators to use to understand sustainability performance when delivering a maintenance service and retrieving parts for reuse?”.

**Step 1.3: Formulate key questions to guide indicator selection**

The outputs of this step are:

- A set of selected relevant business processes and Circular Economy strategies for the particular Circular Economy initiative
- A set of key questions to guide a meaningful indicator selection
- A team of (new) key participants identified by detailing the Circular Economy initiative

To help your team in creating relevant questions, always start by using the umbrella question “What indicators to use to understand sustainability performance when... “, followed by stating a relevant scope.
Step 2 - Select relevant key performance indicators

Step 2 supports the selection of a set of performance indicators for the Circular Economy initiative in focus. Key performance indicators are used to measure performance on key sustainability aspects as well as to provide assistance in a decision-making process. Step 2 consists of four sub-steps, described as follows.

Inputs and support tools
- List of selected Circular Economy strategies and business processes (outputs of Step 1) and key questions
- Team with key participants (outputs of Step 1)
- A digital database and information under ‘Indicator database’ tab.

Time required
- 1-2 hours to perform all the sub-steps under Step 2.

Step 2.1. Establish initial indicator set
The goal of Step 2.1 is to narrow down the number of available indicators to the ones that are potentially relevant for the circular initiative in focus. For that, the combinations of selected Circular Economy strategies and business processes (output of Step 1.3) are used. It may be necessary to start with one combination at a time, to reduce complexity and confusion when selecting the key indicators. For instance, a CE strategy Repair and Maintenance can be combined with Reuse and After-sales service. In order to establish the initial set, filters next to CE strategy Repair and Maintenance, CE strategy Reuse and a business process After-sales service need to be applied using the ‘Indicator database’ tab.

Step 2.2. Prioritise sustainability aspects
A sustainability-related aspect relates to any aspect under environmental, economic and social dimension of sustainability. Therefore, a sustainability-related aspect can be defined as an element of an organisation’s activities, products, or services that has or may have an impact on the environment, economy and society.

The digital database incorporates 12 aspects under environmental dimension,
Example of a prioritisation logic is the selected Circular Economy initiative?

The prioritisation can be based on desirable performance when delivering a maintenance service and retrieving parts for reuse?"

Note: aspect prioritisation is an optional sub-step to (de)select other suitable indicators, or even to Step 1 to redefine the scope. Overall, you can reiterate whichever step if necessary to enhance granularity of the screening process.

Step 2.4. Customise and create new indicators

Some indicators may need to be customised to better reflect your scope. It may also be necessary to create new indicators.

Once you have the overview of the selected indicators (save them in the "Step 3" tab of the digital database), customise and create new indicators (if not too many. In case fewer or more indicators are selected, it may be important to go back and forth between sub-steps to (de)select other suitable indicators, or even to Step 1 to redefine the scope.

Helpbox A - prioritising sustainability aspects

• How relevant is this indicator for your company and industry?
• How relevant is this indicator for your initiative?

Step 2.3. Select suitable indicators

Once you have selected a combination of Circular Economy strategies, business processes, and sustainability aspects, start reviewing the proposed indicators with your team.

During the review process, consider the key question you formulated, as well as specifics of your sector, company, process, product or service, or specifics of the selected Circular Economy initiative.

Additionally, use the set of guiding questions proposed to discuss each indicator, as following:

• Does the use of this indicator involve significant costs or uncertainty of data collection?
• Is this indicator easy-to-use and understand?
• How much data is required to measure this indicator and how big is the amount of indicators to choose from?
• How relevant is this indicator for your company and industry?
• How much data is required to measure this indicator and how big is the uncertainty of data collection?
• Does the data collection of this indicator involve significant costs or time?
• Is this indicator easy-to-use and understand?
• Does the use of this indicator require experts?

When selecting a relevant indicator in the digital database, put an ‘x’ next to it to indicate it was selected. Use the ‘Navigation’ tab in the digital database to be guided through navigation features.

Overall, you can reiterate whichever step if necessary to enhance granularity of the screening process.

Step 2.4. Customise and create new indicators

Some indicators may need to be customised to better reflect your scope. It may also be necessary to create new indicators.

Once you have the overview of the selected indicators (save them in the "Step 3" tab of the digital database), customise and create new indicators (if not too many. In case fewer or more indicators are selected, it may be important to go back and forth between sub-steps to (de)select other suitable indicators, or even to Step 1 to redefine the scope.

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Additionally, use the set of guiding questions proposed to discuss each indicator, as following:

• Does the use of this indicator involve significant costs or uncertainty of data collection?
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Helpbox A - prioritising sustainability aspects

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• How relevant is this indicator for your initiative?

Step 2.3. Select suitable indicators

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During the review process, consider the key question you formulated, as well as specifics of your sector, company, process, product or service, or specifics of the selected Circular Economy initiative.

Additionally, use the set of guiding questions proposed to discuss each indicator, as following:

• Does the use of this indicator involve significant costs or uncertainty of data collection?
• Is this indicator easy-to-use and understand?
• How much data is required to measure this indicator and how big is the amount of indicators to choose from?

Step 2.4. Customise and create new indicators

Some indicators may need to be customised to better reflect your scope. It may also be necessary to create new indicators.

Once you have the overview of the selected indicators (save them in the "Step 3" tab of the digital database), customise and create new indicators (if not too many. In case fewer or more indicators are selected, it may be important to go back and forth between sub-steps to (de)select other suitable indicators, or even to Step 1 to redefine the scope.

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During the review process, consider the key question you formulated, as well as specifics of your sector, company, process, product or service, or specifics of the selected Circular Economy initiative.

Additionally, use the set of guiding questions proposed to discuss each indicator, as following:

• Does the use of this indicator involve significant costs or uncertainty of data collection?
• Is this indicator easy-to-use and understand?
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Some indicators may need to be customised to better reflect your scope. It may also be necessary to create new indicators.

Once you have the overview of the selected indicators (save them in the "Step 3" tab of the digital database), customise and create new indicators (if not too many. In case fewer or more indicators are selected, it may be important to go back and forth between sub-steps to (de)select other suitable indicators, or even to Step 1 to redefine the scope.
needed) considering the specifics of the sector, company, process or product, or the selected Circular Economy initiative. Also, you may use the information that your company already collects to create a new indicator. One of the examples is shown in Helpbox B.

After step 2.4, you should have a list of key indicators to be labelled as the final set for your selection, i.e. either a first combination of a CE strategy and a business process, or the complete Circular Economy initiative.

As stated earlier, a recommended number of indicators for the screening should be between 7 and 15, which would depend of the breadth of the scope considered in Step 1. Essentially, use the checklist, opposite, to ensure the credibility of your final indicator set to make sure it captures important aspects.

**Outputs**
- A set of relevant key performance indicators to calculate performance on social, economic and environmental dimensions

**Key learnings and recommendations**
- It may be beneficial to start working with fewer indicators, then expanding the 'scope' to incorporate indicators from other sustainability aspects, additional circular strategies and business processes.
- Select only key indicators, to eliminate extra effort of unnecessary data gathering.
- It may be necessary to create a 'parking lot' for indicators that are considered important, but require extra effort in data collection. Do not dismiss an indicator just because it is time consuming to calculate it.
- It may be necessary to consult industry associations to understand the sustainability 'areas of concern' that are particular to your sector or material/substance you would like to use; this can facilitate selection of indicators that otherwise could be missed out.

### Helpbox B - creating new indicators

- If the company's objective is to reduce maintenance costs of a product, new indicators can be created to address it. Thus, the indicator 'Volume and number of different chemicals and solvents used for product maintenance' can be developed, being based on the existing indicator, to complement it, an economic indicator 'Costs associated with the use of chemicals and solvents for product maintenance' can be formulated

### A checklist before proceeding to the next step

- **Do you have the right number of indicators?**
  - Do you have the right number of indicators? Remember that the optimal number is between 7 and 15
  - Remove redundant indicators, or use them as complementary to the key ones; remember there is a difference between having 'must' versus 'nice to have' indicators

- **Are they all relevant for the Circular Economy initiative in focus?**
  - Use the tab 'Step 3' in the digital workbook for visualisation of sustainability coverage

- **Are all sustainability dimensions covered?**
  - Use the tab 'Step 3' in the digital workbook for visualisation of sustainability coverage

- **Do they reflect life-cycle thinking?** (If applicable)
  - Life cycle thinking expands the narrow 'gate to gate' approach of traditional manufacturing to a more holistic approach, which includes the pre- and post-manufacturing stages (i.e. resource extraction, production, packaging, distribution, use, maintenance, and eventually recycling, reuse, recovery or final disposal). This approach helps to ensure a more systemic view and reduce the risk of shifting a burden from one stage to another.
The aim of this step is to collect reliable data and calculate key indicators.

Inputs and support tools
- List of final key performance indicators (outputs of Step 2.4)
- Sustainability or data manager
- A digital database and information under ‘Indicator database’ tab.

Time required
- Days or weeks: data collection and indicator application can be considered the most extensive step of the screening, since it requires planning and executing several sub-steps (i.e. planning, data collection, calculating indicators).

Step 3 - Apply final indicator set

The aim of this step is to collect reliable data and calculate key indicators.

Step 3.1. Get overview of data and set up a data collection plan
To start off, compose the final set of indicators and start a data collection process for the Circular Economy initiative and a reference (current) system or any other initiative aiming to address the same problem (as pointed out during Step 1). The digital database and the tab ‘Indicator database’ offers detailed information about each indicator, such as a relevant formula with variables and measurement units. Furthermore, it provides assistance in interpreting the indicator result, under the column ‘Purpose and significance of indicator value’, often providing guidance on how to act to improve the performance.

Each of the chosen indicators would require you to track, collect and manage different data, which needs to be collected for all the options that would be compared on the basis of the selected indicators. Ideally, a sustainability or data manager should create an overview of data that needs to be collected and contact ‘key’ people, who would be responsible to register relevant data and feedback to the data manager, who in turn will set a team to calculate indicators (Helpbox C).

Data can be collected from internal management or technical reports, however, for some indicators it is necessary to collect data externally, from your suppliers, partners or customers. It is important that you try to use the data
you already routinely collect as part of business practice. If you don’t have the dataset required to calculate a given indicator, start focusing on indicators for which you have data readily available. Data collection processes should ensure that collected data is reliable, valid and verifiable, and requires a critical technical assessment.

Step 3.2 Calculate indicators and compare alternatives

Data quality can influence the results of the screening and compromise the decision-making process. While using generic databases may be less costly, collecting data from own operations or value chain actors increases data accuracy and validity. Importantly, the options can only be compared based on the same set of indicators, because only then the real performance can be evaluated, i.e. whether the initiative has a better or worse performance and on what aspects.

Opposite, we provide an example of a calculated indicator set for a reference case and a Circular Economy initiative. Based on the calculation results for both options, it is now more evident how each option performs (‘worse’ and ‘better’ performance are marked red and green correspondingly).

Data quality matrix

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Score</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accuracy, integrity and validity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>own operations and direct suppliers</td>
<td>Independent 3rd party verified data provided with documentation</td>
<td>Non-verified internal data with documentation, or verified data partly based on assumptions</td>
<td>Non-verified data partly based on assumptions, or data based on grey scientific report</td>
<td>Qualified estimate (e.g. by expert), or data based on non-scientific report</td>
<td>Non-qualified estimate, or unknown source</td>
<td></td>
</tr>
<tr>
<td>other value chain actors</td>
<td>Data obtained from value-chain actor directly and provided with 3rd party documentation</td>
<td>Data obtained from value-chain actor directly with documentation</td>
<td>Data obtained from other value-chain actors with poor or incomplete documentation</td>
<td>Data obtained from literature</td>
<td>Unknown source</td>
<td></td>
</tr>
<tr>
<td><strong>Timeliness</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data from current reporting period</td>
<td>Data from previous reporting period</td>
<td>Data from 2 years before reporting period</td>
<td>Data from 3 years before reporting period</td>
<td>Data from more than 3 years before reporting period, or unknown age of data</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Correlation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data from specific site under study</td>
<td>Data from other sites of the company in the same region</td>
<td>Data from relevant sites of the company in other regions</td>
<td>Data from other companies in same region with similar product conditions</td>
<td>Average sector or country data from public or 3rd party database provider</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fontes et al. (2018)
Step 3.3. Use results to support decision

Sustainability screening based on leading indicators aims to support decision-making in a company towards designing and improving any (Circular Economy) initiative to attain greater beneficial outcomes on all dimensions of sustainability. Following the results depicted in the calculated indicator set, it becomes evident that neither of the considered options is ‘the best’, i.e. neither delivers a better performance on all indicators. Our practical experience shows that such results are not exceptions in most of sustainability assessment approaches. The result interpretation therefore is an important activity to carry out in a multidisciplinary team, who should be at the core of the sustainability screening process. We suggest following these key considerations to ensure the results are interpreted and used in the most accurate and beneficial manner:

- ensure that the data quality is similar for all the comparable options
- ensure the consistency of units for collected data and calculated indicators
- link the indicator result to your corporate sustainability objectives; i.e. analyse the ‘severity’ of the result through the lens of your company and its values
- consult your sector association or value chain partners to help clarifying the result.

Furthermore, when one option could show a better performance on most of the indicators, there can still be a risk of trade-offs, i.e. accepting a situation where performance on some indicators has to be compromised. Therefore, it is important that your team discusses the results and utilises decision support tools to make a decision, which can take a direction of redesigning any option to improve its performance, accepting one option to be implemented or rejecting both options and resorting to the development of a new initiative. To support a more informed decision-making and trade-off analysis, CIRCit offers a supplementary tool to assist your company, found on the CIRCit website (www.circitnord.com).

Outputs

- Quantitative comparison of several initiatives (options), based on their economic, environmental and social performance.

Key learnings and recommendations

- It is important to set up a data collection plan
- Ensure validity and quality of data as it influences the accuracy of the result
- Once you learn how to apply the procedure and use the corresponding digital database, it will become a routine for your team to perform screening for any type of initiatives, including emerging Circular Economy ones or any other sustainability-related initiatives, which will facilitate organisational learning about their sustainability implications and provide arena for continuous improvements.

Calculated indicator set

<table>
<thead>
<tr>
<th>Selected indicators</th>
<th>Units</th>
<th>Reference case (as-is)</th>
<th>CE initiative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product weight</td>
<td>kg</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Product and packaging recyclability</td>
<td>Y/N</td>
<td>=* =*</td>
<td>=*</td>
</tr>
<tr>
<td>Waste converted to reusable material</td>
<td>kg</td>
<td>2,052</td>
<td>3,780</td>
</tr>
<tr>
<td>Embodied energy</td>
<td>kWh</td>
<td>17,460</td>
<td>108,000</td>
</tr>
<tr>
<td>Renewable energy for process</td>
<td>kWh</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Compliance with the REACH directive (restricted materials)</td>
<td>kg</td>
<td>NO</td>
<td>YES*</td>
</tr>
<tr>
<td>Purchase of locally produced and offered goods and services</td>
<td>Y/N</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Joint sustainability-oriented initiatives</td>
<td>nr</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Material cost</td>
<td>EUR</td>
<td>720</td>
<td>2,880</td>
</tr>
</tbody>
</table>
About the case
CarpetCo is a carpet manufacturer and provider of a wide range of flooring solutions, including indoor decorations and furnishings, to private and public sectors. CarpetCo’s intention is to create a long-term relationship with customers by providing quality products and offering long-life support services. The main objective is to reduce premature product obsolescence, waste generation and increase customer satisfaction.

Step 1 Define the scope for indicator selection
Step 1.1 Describing the proposed Circular Economy initiative
By consolidating the main corporate intention, CarpetCo has formulated a Circular Economy initiative, which comprises the offering of carpets through a product/service-system, which includes product leasing, installation, repair and maintenance, plus removal at the end of use for recycling back into own products.

Step 1.2 Specifying relevant Circular Economy strategies and business processes
During the discussion in the project team, it has become evident that the initiative affects the:
- type of a product and channels through which the corresponding service will be offered
- product design for repair to fit the desired offering
- type of materials and parts to supply for servicing
- transportation modes for recycling and substitution of raw material by a recycled material.

Using this input and the checklists in tab ‘Step 1’ of the digital database, the Cir-
Step 1.3 Formulating key questions to guide indicator selection

Following the proposed steps, the team now have used the 'umbrella' question “What indicators to use to understand sustainability performance when...” and created several key questions to assist themselves in the next step:

1. What indicators to use to understand sustainability performance when developing a business model based on leasing scheme with repair and maintenance as 'add-on' service?
2. What indicators to use to understand sustainability performance when designing a carpet to be repairable and recyclable?
3. What indicators to use to understand sustainability performance when delivering a repair and maintenance service?
4. What indicators to use to understand sustainability performance when taking back the used carpet and recycling it on site?

After formulating these questions, it has become clearer that for each question a different set of indicators need to be selected. Furthermore, it is also clear who should be engaged in each selection round as the core activities and business processes differ.

Step 2 Selection of relevant key performance indicators

Step 2.1. Establishing initial indicator set

To establish a first set of potentially relevant indicators, the team has set up several combinations of Circular Economy strategies and business processes to identify the indicators for. These combinations match the key questions, so it helps the team to decide which indicators would be more relevant for their scope. The tab 'Step 1' in the digital database has been used to indicate relevant Circular Economy strategies and business processes, shown in the table next to the matching key question.

Now, these combinations should be used in the digital database to filter relevant indicators. To visualise the selection, the team has decided to start with question 2 and corresponding combination. Using the tab 'Indicator database' the filters were set next to two Circular Economy strategies: Repair and Maintenance and Recycle. Furthermore, the Product development was added to match identified business process. Product developers have pointed out that they prefer to understand indicators first for designing a carpet for repair and maintenance, and then for designing for recycling. Therefore, firstly, filters have been set to Circular Economy strategy Repair and Maintenance and business process Product development, with Recycle strategy omitted for now. This example shows the flexibility embedded in the tool to match preferences of the key participants and ease.

Table on the following page shows what indicators the team has selected and justifications why. As seen from the table, initially 12 indicators have been selected.

Step 2.2 Prioritising sustainability aspects

The CarpetCo team decided not to prioritise sustainability aspects and focus on the review of proposed indicators available after filtering, 36 of which covered environmental aspects, 3 - social, and 8 economic.

Step 2.3 Selecting suitable indicators

For this step the team relied on the knowledge of business and product developers and sustainability managers - it was important to ensure that a new product design fits a new business model. A new design is suggested to make a carpet that consists of tiles instead of being a mono-structure to ensure replacement of only the pieces that are worn out and avoid replacing the whole carpet, corners and sides of which are normally not worn because of carpet use patterns. Again in this step, the key question "What indicators to use to understand sustainability performance when designing a carpet to be repairable?" was used to guide selection of important and relevant indicators.

Table on the following page shows what indicators the team has selected and justifications why. As seen from the table, initially 12 indicators have been selected.

Step 2.4 Customising and create new indicators

Following the indicator review process, the team decided to customise indicator 89 to reflect the particularities of
<table>
<thead>
<tr>
<th>#</th>
<th>Indicator name</th>
<th>CarpetCo comments and justification for selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cost of non-destructive disassembly (non-CND)</td>
<td>This is important to consider to ensure the product (carpet) is designed for easy repair of worn out parts (tiles), which affects the labour hour spent on removal of worn parts and installation of new ones</td>
</tr>
<tr>
<td>2</td>
<td>Duration of product use</td>
<td>This indicators can be used to compare longevity of our old carpet model with the new one</td>
</tr>
<tr>
<td>3</td>
<td>Existence of Repair Manual with instructions</td>
<td>Can be important to consider if the repair service will be performed by a third party service provider, who might use these instructions</td>
</tr>
<tr>
<td>4</td>
<td>Availability of repair kit or spare parts</td>
<td>Important because we need to make sure spare parts (tiles) are available anytime they are required</td>
</tr>
<tr>
<td>5</td>
<td>Secondary energy consumption during use phase of the product</td>
<td>We think this is important because we would like to ensure that our redesign makes it easier to clean and maintain the carpet while it's in use (e.g. vacuum cleaning consuming energy)</td>
</tr>
<tr>
<td>6</td>
<td>Water consumption during use phase of the product</td>
<td>Similar to energy indicator. The new design should ensure not much water is required to clean the carpet. Furthermore, we should consider cleaning agents as a potential indicator</td>
</tr>
<tr>
<td>7</td>
<td>Amount of Restricted Materials (REACH) in products</td>
<td>Important to reduce (or eliminate) hazardous/toxic material content in products to minimise health risks and increase potential for open loop recycling</td>
</tr>
<tr>
<td>8</td>
<td>Number of modules</td>
<td>Modular design facilitates repair, reuse and recycling</td>
</tr>
<tr>
<td>9</td>
<td>Time for battery charging</td>
<td>Time for worn part replacement - It's necessary that worn parts are easily accessible and visible, in order to facilitate and economise on the process of their replacement</td>
</tr>
<tr>
<td>10</td>
<td>Painted, Stained and Pigmented surfaces</td>
<td>It is important to ensure that our new design considers elimination of use of any impregnated or glued surfaces. This is to ease repair, but also facilitate recycling</td>
</tr>
<tr>
<td>11</td>
<td>Spare parts and consumables</td>
<td>Important, but coincides with indicator #4</td>
</tr>
<tr>
<td>12</td>
<td>Product Solid Waste Fraction</td>
<td>We need to measure how much product is 'saved' from removal due to our modular design and repair</td>
</tr>
</tbody>
</table>

Data collection plan

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Data</th>
<th>Collection process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of product use - measures the difference of the product's durable life from the market average in its old design version</td>
<td>Wee-out life of a new (redesigned) product and wear-out life of an old product (months)</td>
<td></td>
</tr>
<tr>
<td>Water consumption during use phase of the product</td>
<td>Total mass of water consumed during use phase of the product</td>
<td></td>
</tr>
<tr>
<td>Secondary energy consumption during use phase of the product</td>
<td>Total energy consumed during use phase of the product</td>
<td></td>
</tr>
<tr>
<td>Amount of Restricted Materials (REACH) in products</td>
<td>Total mass of restricted materials present in the product</td>
<td></td>
</tr>
<tr>
<td>Number of modules</td>
<td>Total number of modules in the product</td>
<td></td>
</tr>
<tr>
<td>Time for battery charging</td>
<td>Total time for battery replacement</td>
<td></td>
</tr>
<tr>
<td>Painted, Stained and Pigmented surfaces</td>
<td>Total area of painted, stained or pigmented surfaces</td>
<td></td>
</tr>
<tr>
<td>Spare parts and consumables</td>
<td>Total number of spare parts and consumables</td>
<td></td>
</tr>
<tr>
<td>Product Solid Waste Fraction</td>
<td>Total mass of waste generated from the product</td>
<td></td>
</tr>
</tbody>
</table>

Step 3.2 Calculate indicators and compare alternatives

Once all the key performance indicators are selected, they need to be applied and then used to compare different options, including the selected circular initiative, so to understand their potential performance. Doing this will highlight areas to be improved or altered, giving the opportunity to act before the actual initiative implementation.

Step 3.3 Use results to support decision

On the basis of the calculations and option, CarpetCo decided to proceed with the development of the initiative, which would be supported by the carpet designed for repair. As most of the indicators show, the Circular Economy initiative would make it possible to prolong use life of the product (indicator #2) and almost eliminate resource waste at the end of life (indicator #11). However, the team decided to work on further improving the carpet design and its material composition as it wants to eliminate the restricted substances found in one of the materials (indicators #7).

Key learnings and considerations from the case

Step 1:
- after the team discussion, it became clear that the carpet had to be re-designed to match the new business model that relied on repair and maintenance services - it may be necessary to do sub-steps under Step 1 iteratively and allow more time to understand what actually your Circular Economy initiative
is about and what it requires
• in the initial activities, prefer to
involve too many rather than too
few people, otherwise commitments
can be made without understanding
what effort it required (e.g. delivering
a repair service for a product that is
hard to repair can hardly result in a
profitable business).

Step 2:
• the process of indicator selection was
greatly facilitated by the key ques-
tions formulated in Step 1
• selecting indicators for each question
separately ensured that the selection
is meaningful and indicators are
relevant for the team (e.g. indicator
‘number of modules’ might not have
been useful for the innovation or sus-
tainability coordinator, while it was
important for the product developer, who could also explain its impor-
tance to the team)
• participants with ‘right’ expertise
could greatly assist indicator custo-
misation and creation, so only ‘must’
indicators were selected and used for
the final set.

Step 3:
• get an overview of all key indicators
relevant for the Circular Economy
initiative in focus and the data need-
ed, so same data can be reused in
case it is needed to calculate several
indicators
• make sure that data sources are
properly identified – your customers,
suppliers and partners are sources of
very valuable information, therefore
use them for data collection; as a
company you may be surprised to
learn from your customer that your
product is only used for 1 year de-
spite being designed to serve 2 years
• decision-making is an iterative
process, which allows to collect and
use the ‘right’ information to support
introduction of new and continuous
improvement of past initiatives.

What now?
A detailed sustainability screening of
your Circular Economy initiative paves
the way towards a more structured and
informed decision-making process in
your company, allowing to design a
Circular Economy initiative that also
deliver benefits for the triple bottom
line dimensions of sustainability.

Needless to say, sustainability screening
and leading indicators can also be used
to support analysis and development
of any other sustainability-oriented
initiative. The step-by-step procedure
presented in this workbook is designed
to support corporate learning about
sustainability, which facilitates inte-
gration of sustainability criteria in any
design and development process run by
your company.
References


This workbook supports decision-making by supporting sustainability screening of alternative circular solutions in terms of environmental, social and business potential.