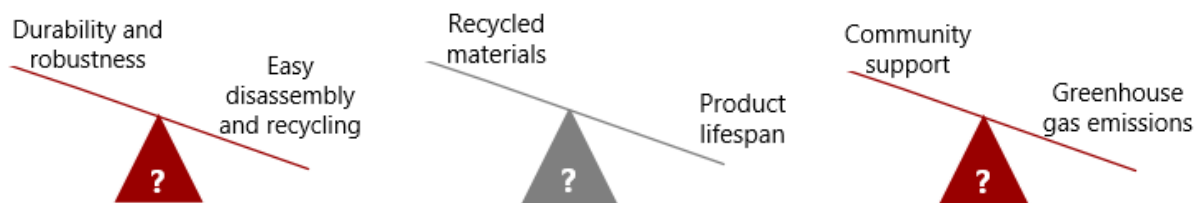


A guidance for navigating trade-offs to support sustainability-related decision-making

The purpose of this guidance is to support decision-making process when sustainability-related trade-offs arise. The guidance relies on a structured step-by-step procedure and support tools embedded in an Excel workbook, both described below.

Importance of navigating trade-offs

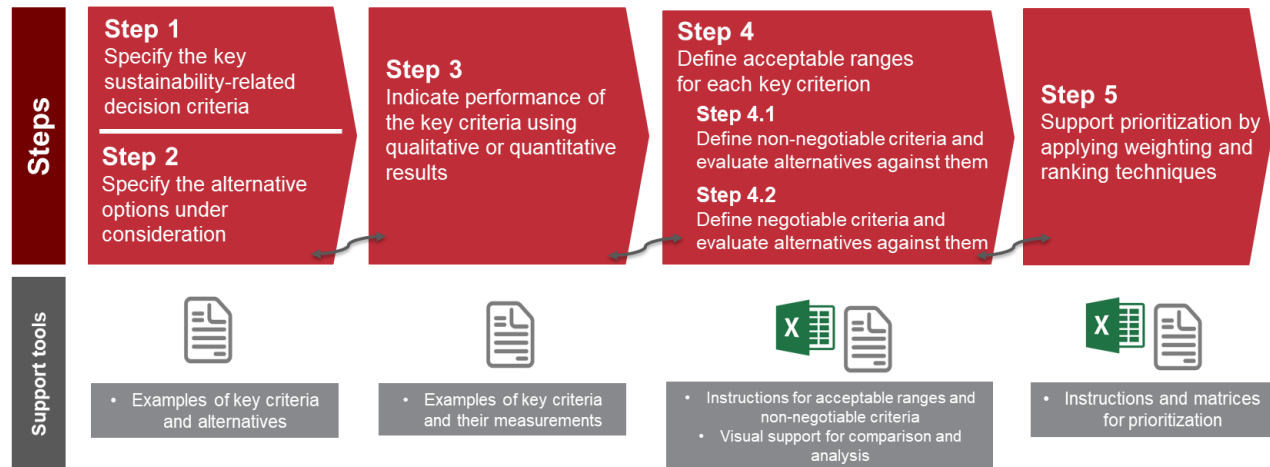
Integrating sustainability into decision-making process facilitates an understanding of potential opportunities and implications of any initiative designed to solve a sustainability-related challenge. Defining and measuring relevant sustainability criteria and using them in the decision-making process helps to focus on high priority areas, which can support decisions during design, development and implementation of sustainability-related initiatives. Operating with key criteria in the early stages allows comparing different alternatives and highlighting areas for improvements. What can be challenging for the decision-makers is the complexity of operating with a broad number of criteria - adding high relevancy environmental, economic and social criteria along key business, technical, functional, legal and customer requirements. Furthermore, those challenges amplify when the performance of the key criteria is contradictory, thus complicating the decision-making process. The contradictions between the desired performance of the key criteria are called *trade-offs*, where it is not possible to achieve the desired performance on all key criteria, thus some criteria should be prioritized over others. It is shown that trade-off situations are often inherent in the decision-making process for sustainability: a product designer experiencing a situation where prioritizing design for durability strategy renders success of realizing design for easy disassembly costly or impossible; similarly, there might be a contradiction between increasing content of recycled materials and a product's lifespan; a business developer experiencing a situation where prioritizing supplier in a developing country to support a vulnerable community abolishes minimization of greenhouse emissions because of long haul transport.



Overview

The guidance relies on a structured step-by-step procedure and support tools embedded in an Excel workbook, as shown in figure 1. The guidance presents each step with elaborations on the activities and support tools designed to support the activities.

A trade-off navigation procedure and tools aim at supporting a structured, transparent and traceable decision-making process by providing guidance for building argumentations and justifications of decisions to avoid haphazard choices.



Who can use the guidance?

The guidance can support any decision-maker at a strategic, tactical and operational level, who are engaged in the development of a sustainability-related initiative. The guidance can support either multidisciplinary teams or teams of business developers, product designers, production and service managers or any expert involved in the decision-making process for sustainability.

When to use?

The guidance can be used anytime a number of sustainability-related criteria are considered for the decision-making process in *the early stages of an initiative development*. A sustainability initiative is any initiative that aims at solving a sustainability-related challenge. Circular economy initiative can be seen as an innovative strategy to address several sustainability-related challenges simultaneously, hence a large focus on it among manufacturing industries nowadays. Despite the benefits a circular economy strategy can help attaining, it, as any other sustainability-related strategy, needs to be developed using relevant sustainability criteria. These criteria can include environmental, social and economic aspects as well as any circular economy related criteria, such as circularity indicators and indices (e.g. material circularity indicator, MCI, by Ellen MacArthur Foundation).

A trade-off navigation procedure – a step-by-step approach

Each step is presented and supported by elaborations of the relevant activities, practical examples and support tools, which are developed in an Excel format and should be used together with the guidance.

Step 1 - Specify the key sustainability-related decision criteria

Sustainability-related decision criteria refer to aspects or objectives that are established as core requirements of proposed designs or options to achieve improved sustainability performance. Criteria can also be expressed in a form of indicators, which show performance on those criteria either in a quantitative or qualitative manner. Therefore, indicators and indexes can serve as decision criteria.

Instructions and support tools

Use A1 sheet to register the criteria. List 7 to 10 key criteria. Key criteria can be derived from high priority sustainability issues of your business. Key criteria can be selected using various procedures or methods (e.g. using leading indicators database available at [CIRCit](#) focus area 1). Additionally, for each criterion an objective can be stated to point out the desired direction for the performance (e.g. increase, decrease, eliminate, etc.). Examples of the key decision criteria are: energy consumption; recyclability of a product; toxicity of a product; community relationships; cost of service provision, etc. with their elaboration provided below.

Criteria	Indicator	Objective
Toxicity of a product	Measured by e.g. type and amount of toxic materials in a product (%)	- To reduce toxic substances in a product - To eliminate toxic substances in a product
Safety at working stations	Measured by e.g. noise levels; physical load index; etc.	- To increase safety by minimizing noise or physical load index
Product recyclability	Measured by % of recyclable material in a total mass of product	- to increase recyclability of a product

Step 2 - Specify the alternative options/designs under consideration

Alternatives are often proposed to improve a certain condition or problem or eliminate inefficiencies. Often, there is a baseline system, alternative 0, which is intended to be improved by proposing several alternatives.

Instructions and support tools

Use A1 sheet to register the alternatives. List 2 to 4 alternatives that are proposed and can be compared between each other using the key criteria from step 1. Few examples are provided below.

Alternative 0 – baseline	Alternative 1	Alternative 2
A product made of virgin material of fossil fuel origin	Use of bio-based and biodegradable materials	Use of recycled materials

Step 3 – Indicate performance of the key criteria using qualitative or quantitative results

To understand the progress towards sustainability requirements (objectives), it is necessary to provide qualitative or quantitative measures for the key criteria.

Instructions and support tools

Use A1 sheet. Use indicator databases or relevant tools to obtain measures for the key criteria (some relevant tools to obtain key criteria can be retrieved from CIRCit project [page](#)).

Examples of key criteria and their measurements

- toxicity measured by weight and type of hazardous materials;
- community relationship measured by the % of produced and offered goods and services purchased locally;
- energy use measured by amount of energy used during use phase of the product

Step 4 - Define acceptable ranges for each key criterion

Acceptable ranges help to set limits for performance acceptability. If an alternative fails to satisfy the defined limits in any criterion, it has to be redesigned or limits adjusted.

Instructions and support tools

Use A1 sheet. Acceptable range might consist of a minimum and maximum value that set lower or higher limits for acceptable performance. Consult other decision makers (if necessary) to define the ranges. Use helpbox below to set the ranges

Helpbox – Setting the ranges

Minimum and maximum values are contextual and should consider internal and external requirements such as:

- Strategic goals or goals set by the decision-making group
- Customer and/or stakeholder requirements
- Technical (and performance) requirements
- Legal requirements and thresholds

Depending on these requirements and the objectives, there might only be a lower value, a higher value or both.

Examples of different ranges considering contextual settings:
for the criteria 'product toxicity' (measured by both type of toxic substances and their concentration) there might be different limits set by two companies

Company A - the maximum and only acceptable limit is 0 for both type and concentration, because it is a requirement of a customer

Company B - the lower value is set to 0 and higher value is set to 2% (of all types of substances, e.g. flame retardants) by total material weight following corporate goal

Step 4.1 - Define non-negotiable criteria and evaluate alternatives against them

Non-negotiable criteria are those where the performance cannot be compromised. An alternative that fails to satisfy any non-negotiable criterion should be adjusted or rejected.

Instructions and support tools

Use A1 sheet to mark which criteria from the list of the key criteria can be classified as are non-negotiable.

Helpbox – Defining the non-negotiable criteria


Non-negotiable criteria can be both set by external conditions as well as by internal strategy, vision and standards, such as:

- Strategic goals and vision (incl. brand image, intra and inter-organizational agreements, etc.)
- Customer and/or stakeholder requirements
- Technical (and performance) requirements
- Legal requirements
- Other (limited commercial risk, market responsiveness)

Use post-its or make notes in the A1 sheet to register all discussions when defining non-negotiable criteria.

Once all acceptable limits are defined, it is possible to see how each alternative performs on each criterion in relation to the respective acceptable limits. The colour coding in A1 sheet will indicate acceptable (green cells) or unacceptable (red cells) performance. It is important to only focus on non-negotiable criteria in this step, therefore, apply filters to select only non-negotiable criteria.


To analyse the results proceed as follows:

 refuse all alternatives that do not satisfy acceptable limits on non-negotiable criteria unless:

A) acceptable limits on non-negotiable criteria can be reconsidered, e.g. by creating a dialogue with other important decision-makers supported by questions:

- why are the criteria non-negotiable?
- why the limits are as they are?
- can the limits be adjusted? if yes, how much should they be adjusted?

B) an alternative/s can be optimized, i.e. consider proposals of how to adjust the alternative

 As a result, proceed only with the alternatives that satisfy updated list of non-negotiable criteria and their limits.


Step 4.2 - Define negotiable criteria and evaluate selected alternatives against them


Negotiable criteria are still important; however, the limits of their acceptable performance can be adjusted more easily than those for non-negotiable criteria. As a rule of thumb, any criterion that was not marked as a non-negotiable in step 4.1. becomes a negotiable.

Instructions and support tools

Compare selected alternatives from Step 4.1. based on their performance according to negotiable criteria. The performance against limits are marked as red (not acceptable) or green (acceptable).

To analyse the results proceed as follows:

 if one or more alternatives satisfy limits on negotiable criteria - prioritize the alternative whose performance is closer to the desired objective (e.g. closer to the desired maximum or minimum);
Note: use A2 sheet in case support is needed for prioritization.

 if none satisfies the limits on negotiable criteria or show conflicting performances, discuss the following and note the discussion points:

- can any alternative be optimized or limits adjusted?
- can additional projects mitigate the compromised performance on some criteria?
- can you consider performance of non-negotiable criteria from Step 4.1. to support justifications and prioritization? (i.e. prioritizing the alternative whose performance of non-negotiable criteria is closer to the desired objective (e.g. closer to the desired maximum or minimum) despite delivering lower performance of negotiable criteria?)

This step is iterative where it can be necessary to return to previous steps to support justifications and argumentations to which alternative to favour. If the prioritization is challenging, proceed to Step 5. and use A2 sheet for weighting and ranking.

Step 5 - Support prioritization by applying weighting and ranking techniques

Weighting criteria and ranking alternatives in a team of decision-makers provide more transparency about prioritization process and help recording judgements why alternative was accepted or rejected.

Instructions and support tools

Use A2 sheet. This technique can support decision process in case of a challenging prioritization of alternatives with conflicting performances in Step 4.2. Essentially, any prioritization technique can be used to prioritize criteria and alternatives. As an example, A2 sheet accommodates a pairwise comparison and alternative ranking matrices. A pairwise comparison matrix can be used to compare the negotiable criteria from Step 4.2. between each other and use the results to support ranking of alternatives. It is important to agree on the ranking scale and use it consistently to support the process. At the end of the ranking process, the overall score for each alternative would be revealed. This technique can strengthen the judgements about what negotiable criteria have more importance, thus driving the selection of one alternative over others.

Making a decision

To make a decision it is necessary to consider all the argumentations and justifications provided during the process. It may be that ranking in step 5 helps clarifying what criteria are most important, however the decision should not only be based on the score but rather on a combination of a score and arguments provided during the process.

The procedure and supporting tools are designed not to indicate what alternative is 'the best', but to encourage contextual evaluation of performance and support argumentations of decisions. This facilitates a dialogue about the performance of the alternatives under consideration from a broader perspective, including contextual requirements, their importance and flexibility. As a result, it supports more structured, transparent and traceable decision-making process, the results of which can be used to plan other projects and inform other decision-makers.

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