

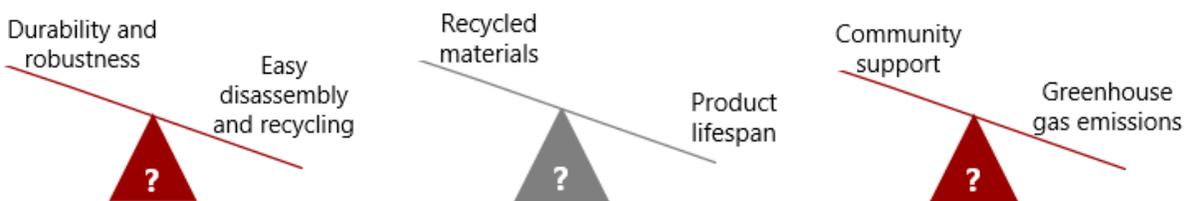
# A guidance for navigating trade-offs to support sustainability-related decision-making

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

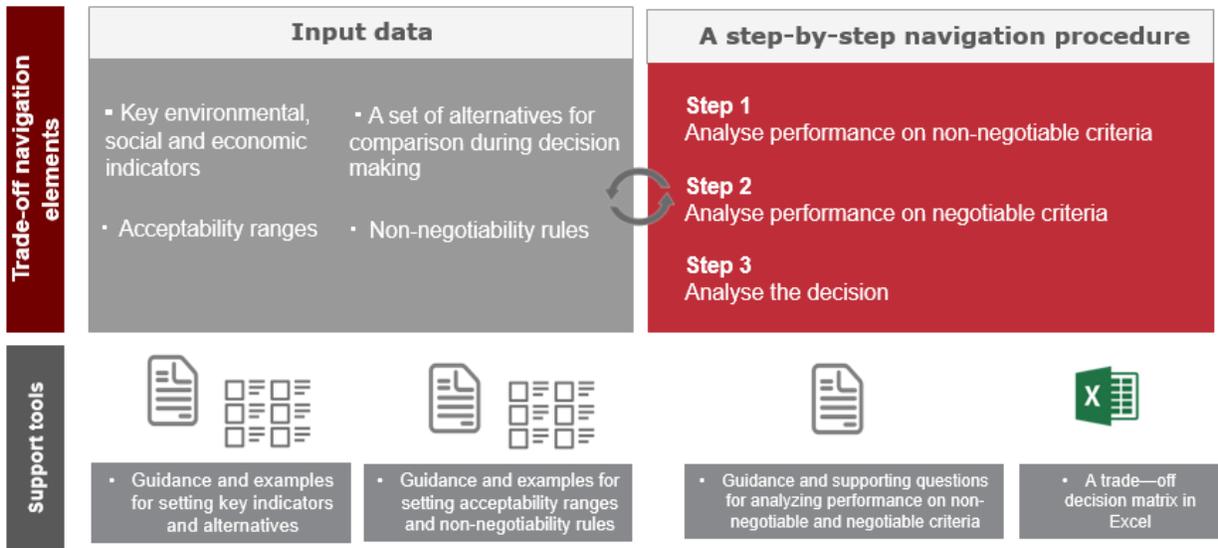
Integrating sustainability into decision-making process facilitates an understanding of potential opportunities and implications of any initiative designed to solve a sustainability-related challenge. Defining and measuring relevant sustainability criteria and using them in the decision-making process helps to focus on high priority areas, which can support decisions during design, development and implementation of sustainability-related initiatives. Operating with key criteria and indicators in the early stages allows comparing different alternatives and highlighting areas for improvements.

What can be challenging is the complexity of operating with a broad number of criteria or indicators – 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 a supplier in a developing country to support a vulnerable community abolishes minimization of greenhouse emissions because of long haul transport. This guidance, therefore, acknowledges a presence of trade-offs between sustainability criteria and aims at helping a decision making team to analyse proposed alternatives and openly discuss existing trade-offs and their implications in light of the contextual settings.



## Overview

The guidance follows a structured step-by-step procedure relying on specific input data and support tools embedded in an Excel workbook, as shown in a figure below. The guidance presents requirements to the input data and their examples, followed by elaborations of activities in each step of the procedure. The procedure and support tools aim at enabling 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 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. Sustainability criteria include environmental, social and economic criteria as well as any circular economy related criteria, such as circularity indicators and indices (e.g. material circularity indicator, MCI, by Ellen MacArthur Foundation). As a result, these criteria can be added to reveal existing trade-offs and support argumentations for making a particular decision involving trade-offs.

## A trade-off navigation elements: input data and a structured procedure

### Input data

Input data are required as they act as a pre-condition to reveal trade-offs and provide visibility of the decision framing, therefore, are necessary to include in the decision-making and support trade-off analysis.

Input data show what information is required to frame a decision. Below is a guidance on understanding key input data and its examples. Once all required input data is collected, it should be registered in 'Trade-off decision matrix' available in the Excel workbook.

Input data	
▪ Key environmental, social and economic indicators	▪ A set of alternatives for comparison during decision making
▪ Acceptability ranges	▪ Non-negotiability rules

### Specifying key sustainability-related decision criteria or indicators

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.

#### Guidance and support tools

Key criteria/indicators 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/indicator 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/indicators are: energy consumption; recyclability of a product; toxicity of a product; community relationships; cost of service provision, etc. with their elaboration provided in a table below. For each criteria/indicator a measurement unit should be indicated, either as a qualitative or quantitative value.

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

Use a 'Trade-off decision matrix' sheet to register selected criteria/indicators. List 7 to 10 key criteria/indicators as adding more can complicate the decision process.

### Specifying a set of 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 sought to be improved by proposing several alternatives.

**Guidance and support tools**

Use a ‘Trade-off decision matrix’ sheet to register the alternatives. List 2 to 4 alternatives that are proposed and can be compared between each other using the key criteria/indicators. Few examples are provided below. Adding more than 4 alternatives can complicate the decision process.

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

**Defining acceptability ranges for each key criterion/indicator**

Acceptable ranges help to set limits for performance acceptability, i.e. visualize the extent to which a performance is satisfactory or not. If an alternative fails to satisfy the defined limits in any criterion, it has to be redesigned or limits adjusted.

**Guidance and support tools**

Acceptable range might consist of a minimum and maximum value that set lower or higher limits for acceptable performance. Ideally, acceptability ranges should be set at the beginning of developing a sustainability initiative; for that a number of internal and external decision makers should be consulted to define the ranges. A helpbox below provides examples of sources to support setting 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

Use a ‘Trade-off decision matrix’ sheet to register the acceptability ranges and their sources (references).

**Defining non-negotiable criteria**

Non-negotiable criteria are those whose performance cannot be compromised. Non-negotiable criteria can change from project to project; therefore, their non-negotiability should be discussed in the decision making team with elaborations on why they are classified as non-negotiable.

### **Guidance and support tools**

Use a 'Trade-off decision matrix' sheet to mark which criteria from the list of the key criteria can be classified as 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 Excel sheet to register all discussions when defining non-negotiable criteria. Now that all the input data were defined/collected, follow a step-by-step guidance to reveal trade-offs and provide justifications for their acceptability.

### **A step-by-step navigation procedure**

Once all the input data is defined and registered, it is possible to see how each alternative performs on each criterion in relation to the respective acceptable limits.

The colour coding in 'Trade-off decision matrix' sheet will indicate acceptable (green cells) or unacceptable (red cells) performance. The decision process should follow the steps:

#### **Step 1: Analyse performance on non-negotiable criteria**

In this step, the focus is done on the non-negotiable criteria. All the alternatives should be compared based on their performance on non-negotiable criteria.

- A. If *two or more* alternatives satisfy all the non-negotiable criteria, proceed to Step 2.
- B. If *only one* alternative satisfies all the non-negotiable criteria, proceed to Step 3.
- C. If *none* of the alternatives satisfy all the non-negotiable criteria, i.e., either some alternatives deliver the acceptable performance on some criteria but not the others, or neither of the alternatives deliver the acceptable performance, then all the alternatives should be rejected, unless:

#### **A step-by-step navigation procedure**

##### **Step 1**

Analyse performance on non-negotiable criteria

##### **Step 2**

Analyse performance on negotiable criteria

##### **Step 3**

Analyse the decision

The non-negotiability of the criteria, hence the acceptable ranges, can be re-evaluated, supported by the questions:

- Are the acceptability ranges too narrow or too broad?
- Can they be adjusted and how much?
- What is the aim of the defined acceptability ranges/target? (Does it show a problem/risks or an opportunity? Can it be seen as an approach to balance the objectives? Does it reflect means to achieving a specific goal?)
- Can we re-evaluate the ranges/target in a dialogue with stakeholders or management?

This step requires returning back to the input data to re-evaluate: (i) acceptability ranges; (ii) number of considered alternatives; (iii) number and type of key criteria for decision-making.

As a result of the re-evaluation, some ranges might be adjusted and the evaluation should proceed as follows:

- A. If *none* of the alternatives satisfies all (adjusted) non-negotiable criteria, none can be accepted as is, requiring improvement or development of a new set of alternatives.
- B. If *two or more* alternatives satisfy all the non-negotiable criteria, proceed to Step 2.
- C. If *only one* alternative satisfies all the non-negotiable criteria, the analysis should proceed to Step 3.

### **Step 2: Analyse performance on negotiable criteria**

Use 'Prioritization matrix' in the Excel workbook

- A. Select only the criteria for which none of the alternatives meet the performance within the acceptable ranges (e.g., if one criterion is satisfied by all the considered alternatives, it should be excluded from the analysis to simplify the weighting). For the selected criteria, weights should be assigned to them. A weight indicates the importance of one criterion relative to the other under consideration, i.e., a pairwise comparison. It is important to agree on the ranking scale and use it consistently to support the weighting process. A Likert scale from 'much more important' to 'much less important' could be used to assign priority weights. In doing so, the weights will express levels of trade-offs between the criteria rather than in absolute terms. After weighting, a ranking of alternatives is performed based on their performance and the degree they satisfy the acceptable ranges. Similarly, a ranking scale should be defined, such as 1 to 3, i.e., from unsatisfactory (1), to some extent satisfactory (2), to satisfactory (3). As a result, the weighting score and the ranking score will be combined to show the alternative/s with the most satisfactory scores.
- B. Following the results of the weighting and ranking process, a dialogue about the scores and whether they can help provide judgements for the prioritization of one alternative over others is encouraged.
- C. Proceed to Step 3.

### **Step 3: Decision analysis**

In this step, it is necessary to reflect back on the selected alternative(s) based on the results in Step 1 and 2. All the criteria, negotiable and non-negotiable, should be considered, to allow decision analysis to be performed in light of potential trade-offs between all the criteria considered. To make a decision, it is

necessary to consider all the argumentations and justifications provided during the process. The following deliberations could occur: if the alternative X is accepted—can its performance on the non-negotiable criteria and high priority negotiable criteria compensate for the trade-offs that are accepted? If yes, does it reflect our goals and provide a new opportunity and minimize risks? Can alternative solutions be set up to compensate for the accepted trade-offs?

## **Making a decision**

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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