# CEDR

Conférence Européenne
des Directeurs des Routes

Conference of European
Directors of Roads

# SPADE Guidelines



March 2021

# SPADE Guidelines

by

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Report D4.6 is an output from the CEDR Transnational Road Research Programme Call 2017: Collaborative Planning. The research was funded by the CEDR members of Austria, Finland, the Netherlands, Norway, Sweden and UK.

The Project Executive Board for this programme consisted of:
Asfinag (Austria), Highways England (UK), Rijkswaterstaat (Netherlands), Trafikverket (Sweden), Väylävirasto (Finland), Vegvesen (Norway)

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Norwegian Centre for Transport Research

# Executive summary

The SPADE method enables integrated planning through a collaborative decision-making process. It combines four planning methods, CBA, MCA, e-participation and a digital workshop into a single method. The combination of these methods and the synergies between them make SPADE a powerful integrated planning method.

This method has been developed in response to the question raised by CEDR: *'How to achieve integrated project development of infrastructure and its spatial surroundings?'* SPADE consists of two main components, a tool and a process. The tool provides quantitative insights in the potential of different measures or policy options and structures the discussions between stakeholders. The process ensures the incorporation of the method in a collaborative planning process.

The SPADE method improves the planning process by (i) reducing the number of policy options, (ii) gaining a deeper understanding of the effects of planning measures, in particular qualitative effects, and (iii) gaining stakeholder support. The method is applicable in many different planning situations. Moreover, the method is flexible and gives the organiser the freedom to adapt the method to his own needs of the planning process. An overview of the steps of SPADE method is given below.
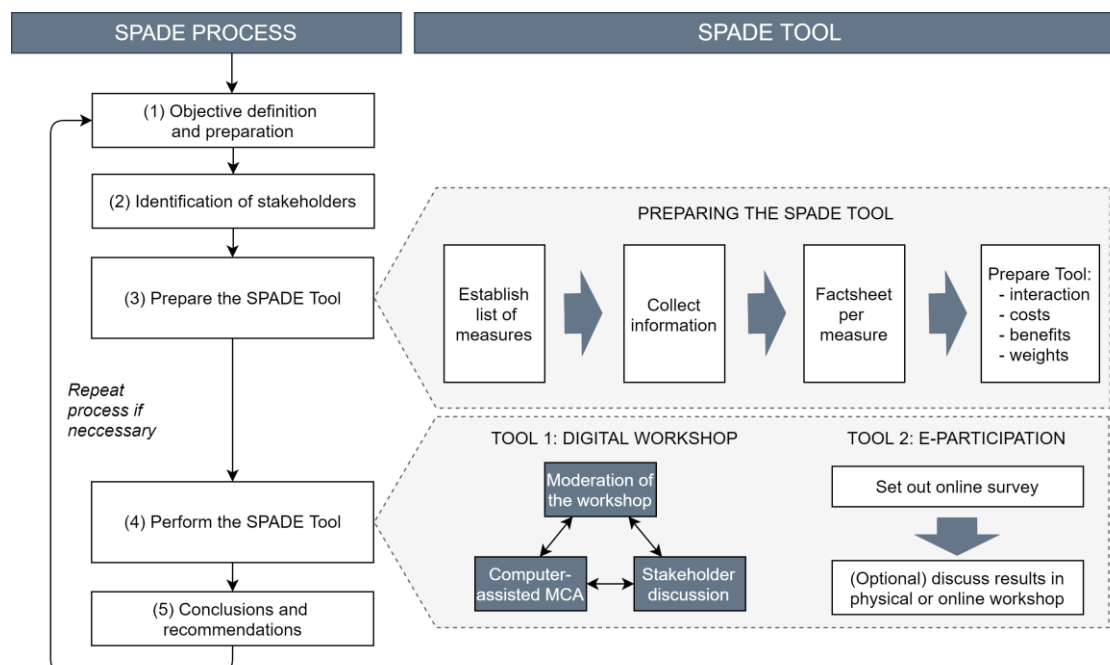


*An overview of the SPADE method. Source: Authors.*

This document presents the guidelines on how to use the SPADE method. To facilitate carrying out the SPADE method, the SPADE tool is available in an Excel spreadsheet. The tool can be downloaded from the download section at the project website at www.spade-project.eu. The guidelines are primarily intended for NRA's, but they can be used by anyone who can use support in decision-making between various options, such as planners, managers, policy makers or consultants.

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# Introduction

The CEDR Transnational Research Programme was launched by the Conference of European Directors of Roads (CEDR). CEDR is the Road Directors' platform for cooperation and promotion of improvements to the road system and its infrastructure, as an integral part of a sustainable transport system in Europe. Its members represent their respective National Road Authorities (NRA) or equivalents and provide support and advice on decisions concerning the road transport system that are taken at national or international level.

The participating NRAs in the **CEDR Call 2017: Collaborative Planning** are **Austria, Finland, Netherlands, Norway, Sweden** and the **United Kingdom**. As in previous collaborative research programmes, the participating members have established a Programme Executive Board (PEB) made up of experts in the topics to be covered. The research budget is jointly provided by the NRAs as listed above.

National Road Administrations in Europe expressed the need for an innovative approach that addresses the multi-dimensional challenges of infrastructure planning, such as integrated spatial development, timing, valuation, quality of life as well as collaboration of stakeholders. The Conference of European Directors of Road (CEDR) therefore raised the question:

*'How to achieve integrated project development of infrastructure and its spatial surroundings?'*

The SPADE method, an integral infrastructure planning method, provides an answer. SPADE is a method to involve stakeholders in the decision-making process. It combines four planning methods, CBA, MCA, e-participation and a digital workshop into a single approach. The synergies between them make SPADE a powerful integrated planning method. The different steps of the SPADE method are shown in Figure 1.

The theoretical basis for the SPADE method is developed in deliverable 3.2: *'Review of literature and best practices'*. A first version of the method is presented in deliverable 4.1: *'Concept assessment method and draft guidelines'*. This concept version of the method has been tested in three case studies, as shown in the combined deliverable 4.3, 4.4 and 4.5: *'Case Study Report'*.

This deliverable, the *'SPADE Guidelines*', contains the instructions to carry out the SPADE method in practice. This report explains step by step how to carry out the SPADE method. This report is intended for planners or others who wish to apply the SPADE method.
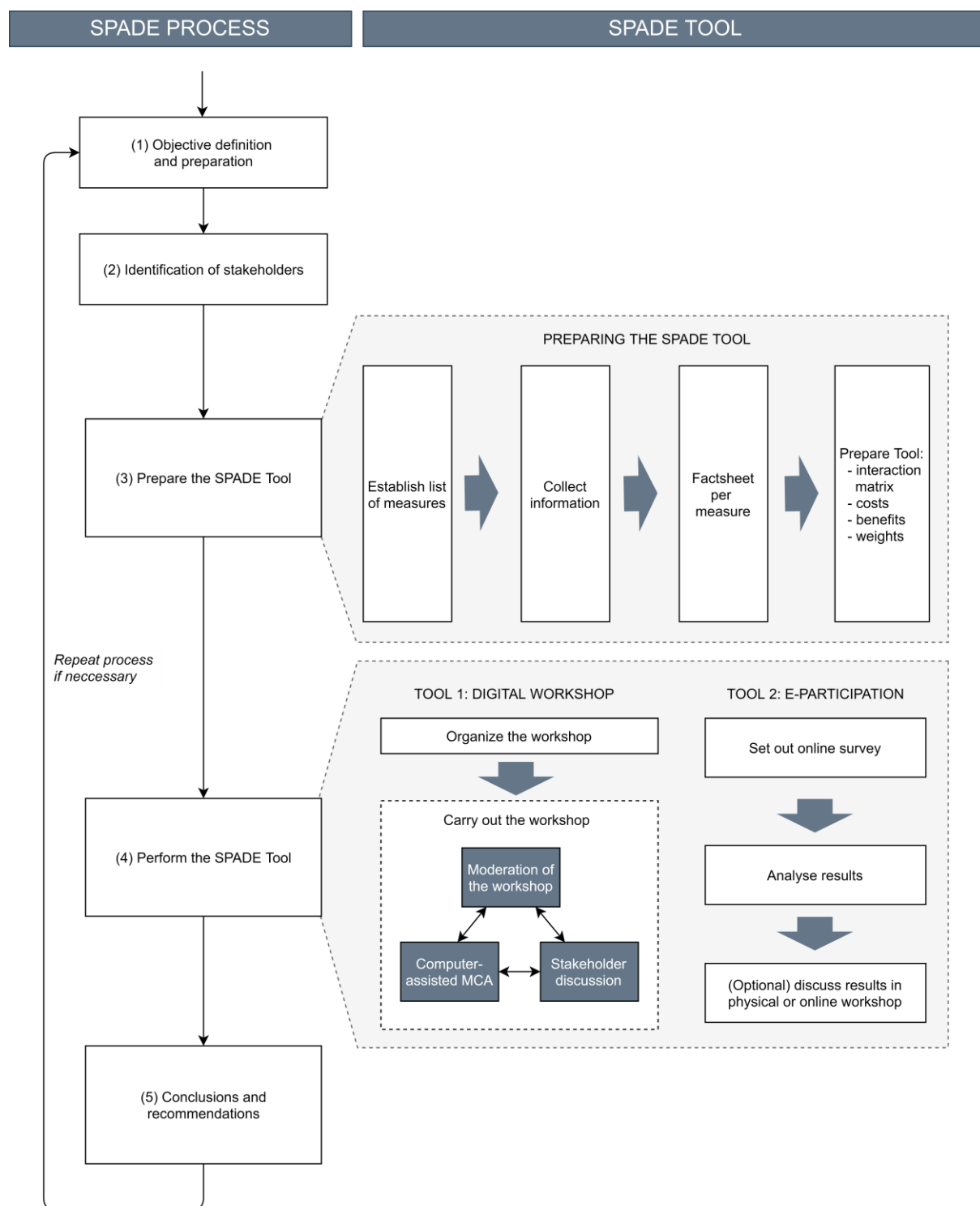
*Figure 1: Visual depiction of the SPADE method, showing the SPADE process and SPADE tool combined into a single in the workflow. Source: Authors*

# Step 1: Objective definition and preparation

**Objective**   Plan the application of SPADE in the planning process

**Outcome**   Knowing between which options a choice needs to be made and which stakeholders are to be involved in the assessment

The SPADE method facilitates decision-making method processes. The method helps to make a choice when there are different options on the table. Which (set of) infrastructural measures contribute most to solving the bottleneck? Which policy actions can best be implemented to reach a certain goal?

The SPADE method is used to narrow down a long list of options (such as policy actions or infrastructure solutions) to the most valuable in a structured manner. The method uses various data sources, such as numbers, but also opinions of different stakeholders. Based on this data, the method helps to identify which options are most preferred.

SPADE is therefore a suitable method if you want to achieve any of the following goals:

> **Objective 1:** *To reduce a longlist of options/measures into a shortlist of options/measures*

> **Objective 2:** *To gather opinions of various stakeholders on various options/measures*
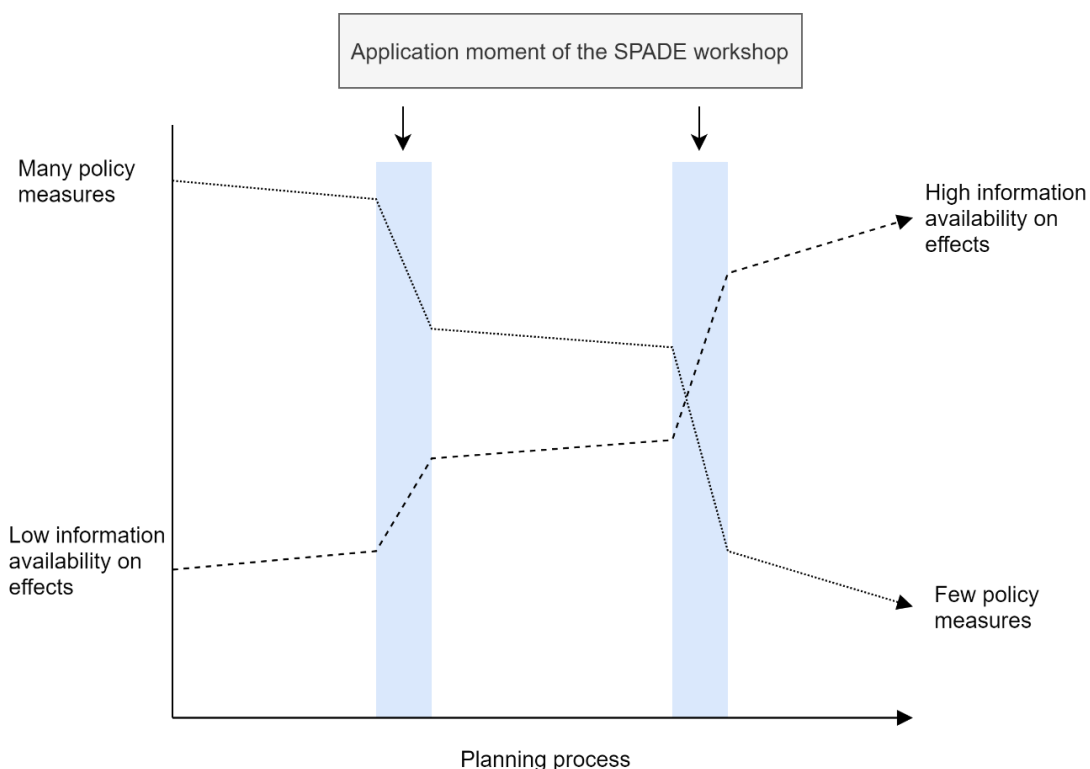


*Figure 2:*        *The contribution of SPADE in the planning process. Source: Authors*

By involving stakeholders in the decision-making process, not only is qualitative information such as opinions or expert judgement included in the assessment, but stakeholders are becoming part of the decision-making process, which increases their support for the outcome. The method thus also supports the creation of a common understanding of the challenges and the possible solutions among the stakeholders.

The SPADE method improves the planning process by (i) by reducing the number of potential planning solutions; (ii) by gaining deeper understanding of the effects of potential planning measures, in particular qualitative measures; and (iii) by gaining stakeholders support through their involvement in the decision-making process.

# Step 2: Identification of stakeholders

**Objective**      Identify the relevant stakeholders and invite them to participate in the process.

**Outcome**      Overview of the relevant stakeholders to be involved in the SPADE method

Once the objective of the case study is clear, the next step is to identify the relevant stakeholders that shall be involved in the method.

Stakeholders are included in the assessment for two reasons. Firstly, stakeholders are needed who can make a substantive contribution to the assessment of the measures/options. This mainly concerns giving an expert judgement on measures that are difficult to estimate in a quantitative way. Secondly, it gives stakeholders a sense of involvement in the decision-making process.

Depending on the case, the stakeholders may come from different backgrounds, such as municipalities, regional or national governments, different departments within the government (e.g. spatial planning department or mobility department), representatives of interest groups and associations, or the local population.

Once the stakeholders are identified, they should be approached and invited to be involved in the process. Usually, some stakeholders are already involved in the process one way or another.

If some stakeholders do not wish to be involved, it can become a difficult process. In that case, SPADE may not the right solution. SPADE is best suited if the stakeholders are open to finding consensus. In addition, it can be time-consuming for the organiser to involve every stakeholder. Interest groups, for example, are difficult to reach and for this reason are often not involved in the process. However, in order achieve collaborative planning, they will need to be involved. The organiser therefore has a great responsibility in making the process truly collaborative.

# Step 3: Prepare the SPADE Tool

**Objective**    Prepare factsheets of the measures to be evaluated with SPADE, which serves as an input for e-participation or the digital workshop

**Outcome**
- List of measures to be evaluated
- List of criteria based on which the measures are evaluated
- Factsheets of each measure with information about the measure
- Survey used to carry out the SPADE tool

Having prepared the case (step 1), and approached the stakeholders (step 2), the SPADE tool is prepared in step 3.

## 3.1.  Prepare a longlist of list of measures to be evaluated

The aim of the SPADE method is to narrow down a longlist of measures (policies, infrastructure solutions) into a short-list. Therefore, a longlist of measures needs to be prepared. This long list contains all measures that shall be evaluated within the SPADE tool.

The longlist can be as long as necessary. However, the longer the longlist, the less time is available to assess each measures in detail. Therefore, the suggestion is to have a maximum of between 10 and 20 measures in the longlist. More measures are also possible, but then the assessment may take too much time. Of course, a shorter list is also possible. This allows for exploring each measures more in-depth.

The measures do not have to be mutually exclusive. It is possible to have some overlap between the measures. If needed, certain variants of a single measure can be included in the long-list. Usually, some of the measures are already defined earlier in the planning process. If necessary, the organiser can consult the stakeholders for potential other solutions or organize workshops aimed at generating measures. It must be borne in mind that this can involve a great deal of work.

**What are 'good' measures?**

- The measures should be clearly defined so that there are no different interpretations possible.
- The measures need to be somewhat in similar stages of the planning process, otherwise the measures are difficult to compare.
- When there are very different types of measures, e.g. hard and soft infrastructure measures, group them and do the assessment within the group

## 3.2. Collect information & develop factsheets

Once a list of measures has been established, each measure shall be described in a **factsheet**. The factsheets contain detailed information about each measure and its effects. These information sheets serve the purpose to inform the participants about the measures. A template for a factsheets is included in the appendix (Appendix A: Factsheet Template). The factsheet typically consists of the following components:

- **Current situation**: description of the current situation in relation to the problem;
- **Solution**: description of the proposed measure;
- **Image** if available, an image showing the solution;
- **Impact**: expected impact of the solution, categorized according to various criteria (more on which criteria shall be described is found in section 3.3);
- **Sources**: sources used for the factsheet (for example reports or data sources).

The content and size of the factsheets can differ from project to project. If around 20 measures are evaluated and a 'rough' assessment is needed to separate the wheat from the chaff, a description per measure of around five sentences will suffice. If a more thorough evaluation for, say, five measures is needed, more detailed factsheets are necessary. If a great deal of information about the measures is already available, for example, through preliminary research, it is useful to include this information in the factsheets, so that no information from previous research is lost.

## 3.3. Prepare the Tool

Once the measures have been prepared, the next step is to prepare the SPADE tool. In the SPADE tool the assessment of the measures in the longlist takes place. The assessment is done in three steps. Table 1 provides a description of each step and who shall provide the input for each step.

*Table 1: Components of the SPADE tool*

| SPADE tool step | Description | Carried out by who |
|---|---|---|
| *1. Interaction matrix* | Indicates whether measures strengthen or weaken/exclude each other. | Organiser |
| *2. Criteria* | Estimation of the costs and benefits of each measure, according to various criteria (e.g. accessibility, economy or environment) | By the organiser is quantitative information is known, by stakeholders if qualitative input is needed |
| *3. Weights of various criteria* | Weights for each criteria. The higher the weight of a criterion, the more it counts in the final result. | Usually done by stakeholders, however, weights are often determined politically. |

## The SPADE tool

The SPADE tool is accessible in an Excel spreadsheet which can be downloaded from the download section at the project website at www.spade-project.eu.
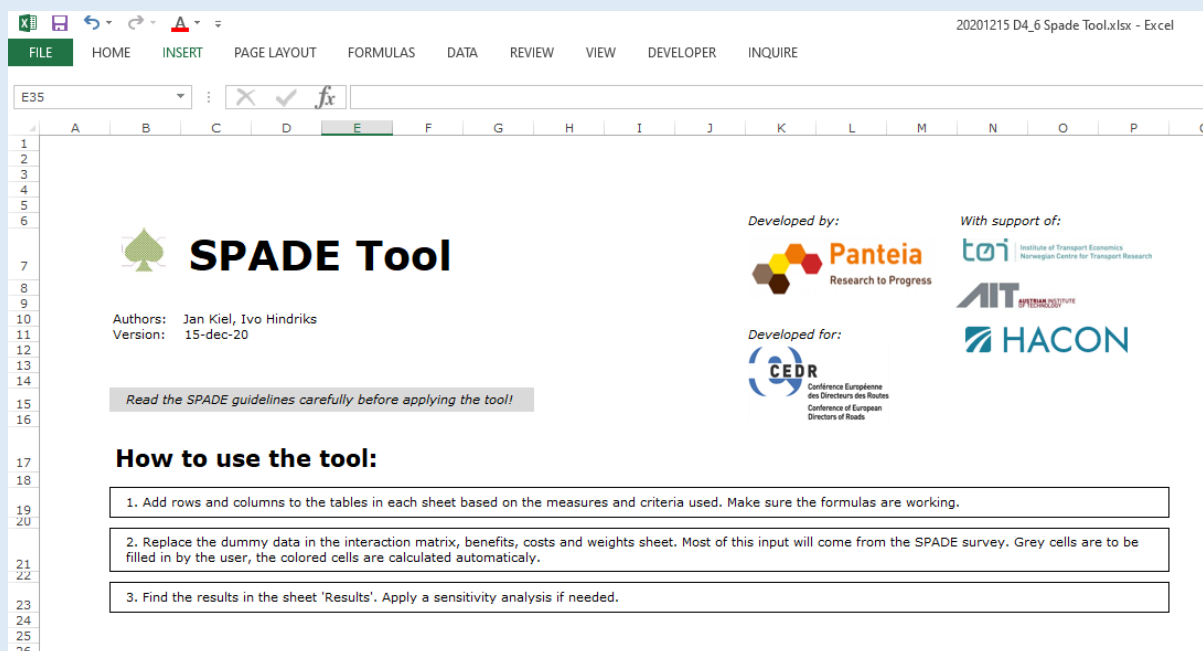


*Figure 3: Screenshot of the SPADE tool in Excel. Source: Authors.*

The SPADE tool is accessible in an Excel spreadsheet and can be downloaded from the download section at the project website at www.spade-project.eu. This excel sheet explains how the tool works and how to adapt it to fit your use case.

The most crucial aspect designing the SPADE tool for your case is the following question:

> *According to which criteria shall de measures in the long-list be evaluated?*

The criteria used in the tool are the foundation of the SPADE tool. These criteria determine which measures are favoured. Each measure shall be scored according to these chosen criteria. The organiser can decide to fill in these scores themselves, or let the stakeholders fill in a score. If quantitative information is available, such as for example the estimated costs of the measures, this information can be filled in. For criteria in which the effects are more difficult to determine, such as the impact of an infrastructural measure on the landscape, expert judgement is preferable. These scores will be filled in by the stakeholders. How stakeholders can fill in the SPADE tool is described in step 4.

The organiser needs to make a decision on which criteria to use. Generally speaking, one evaluation criterion for evaluating the costs is used. This criterion covers all financial costs involved in the realisation, operation and maintenance of the measure, including the risks.

However, the organiser may decide to split this criterion, for example into the criteria 'investment costs' and 'maintenance costs'.

In order to assess the benefits, it is common to use a lot more criteria for the assessment of the measures. The most commonly used criteria are '*accessibility*', '*economy*', '*environment*', '*safety*' and '*quality*'. However, other criteria can be added as well, such as '*policy compliance*', which refers to the extent to which the measure is consistent with policy objectives or '*public and political support*', referring to whether the measure can count on support from the public and from politicians. In addition, it is sometimes useful to make a distinction between different modalities such as car, public transport, train and bicycle.

When the longlist consists of 10-15 measures, we recommend to use 6 or 7 criteria in the assessment. With 5 measures, we recommend around 10 criteria. If too many criteria are used, the assessment can take too long, which can have an effect on the motivation of the stakeholders. Appendix B: SPADE Impacts Glossary provides an overview of different criteria to use in the assessment. The criteria usually correspond to the objectives/goals defined earlier in the process.

## Using SPADE for assessing policy actions

In case policy measures are assessed infrastructural measures, a common evaluation framework are the following three criteria:
- **Urgency**, which relates to the speed with which an action has to be implemented and indicates the time-frame within which it should be carried out;
- **Impact**, which signifies the effectiveness of an action in overcoming a related 'challenge', as well as its influence on other 'challenges'.
- **Feasibility**, which encompasses the practicality of implementing an action.

Finally, a weight needs to be applied to each criterion. The weights are usually given by stakeholders, however, weights are also often determined politically. If the stakeholders are asked to provide a weighting, this shall be done in two steps. First, the weighting between the costs and benefits shall be determined. Second, the weights between the different benefits (or costs, when there are multiple criteria for the costs) need to be weighted.

In conclusion, the third step of the method produces the following results:

- Longlist of measures to be evaluated
- List of criteria based on which the measures shall be evaluated
- Factsheets of each measure with information about the measures

The longlist of measures, the criteria and any available information are implemented in the SPADE Excel tool. The following step explains how stakeholders are involved and how stakeholder input is gathered for the SPADE tool.

# Step 4: Perform the SPADE Tool

| | |
|---|---|
| **Objective** | Collect feedback from the stakeholders using e-participation and/or a digital workshop |
| **Outcome** | <ul><li>Final score, with a ranking of the measures and a ranking of the measures per criteria.</li><li>Insight into how stakeholders score the measures on different criteria</li><li>If a workshop has been held, the organiser has insight into the motivation behind the scores</li></ul> |

In the fourth step, input from stakeholders is gathered to complete the SPADE tool. The stakeholders will rate each measure for each criteria on a pre-defined scale, except for the measures and criteria that are filled in in advance by the organizer. In addition, the stakeholders can discuss the ratings and the final score with each other. This makes the SPADE method a participatory planning method. The stakeholders discuss with each other what the best option is.

*Table 2: The SPADE method can be applied in two ways, via e-participation or via a digital workshop*

| | E-participation | Digital workshop |
|---|---|---|
| *Description* | Carried out through an online survey. The stakeholders provide input by rating measures on different aspects. If needed, the results of the online survey are discussed later via a physical or online workshop | Carried out live in a workshop. Stakeholders rate measures via a device while discussing the choices, results and differences with each other in a moderated session. |
| *Participants* | The e-participation survey can be sent out to an unlimited amount of respondents. If combined with a workshop, 10-15 participants are recommended. | For an effective discussion during the 'live' digital workshop, a group of 10-15 participants is recommended |
| *Technical requirements* | Online survey software, which is often available for free as a basic tool, such as Mentimeter. | Survey software that enables rating and basic analysis in a local setting such as Meetingsphere or Mentimeter is needed, as well as one device (computer/tablet/phone) per workshop participant. |
| *Application* | <ul><li>Survey can include potentially an unlimited amount of stakeholders</li><li>No interaction possible between the stakeholders during the rating</li><li>Follow up workshop needed to discuss results.</li><li>Survey can be completed when it suits the participant</li><li>Faster than the digital workshop</li></ul> | <ul><li>Stakeholders are able to motivate their choices</li><li>Stakeholders can discuss measures and impacts directly,</li><li>Discussions can be lengthy if not moderated properly</li><li>Requires more organisation</li></ul> |

How stakeholders provide input depends on the method used by the organizer. Two methods are suitable for this, **e-participation** or a **digital workshop**. Both tools vary slightly and require preparation. A hybrid method is possible as well.

Whichever tool is used, the format in which the stakeholders provide input is the same. This is done via a survey. More information on how a survey is designed is included in Appendix C: Designing the SPADE survey. After the survey has been completed, the results are processed in the SPADE tool. See Appendix D: The SPADE Tool Methodology for more information on calculation methodology behind de SPADE tool.

The results are then discussed in an online of offline workshop. In a digital workshop, the answering and the interpretation of the answers are done simultaneously.
The workshop should preferably be led by someone who has experience with the method.
For a successful workshop, the following points should be taken into account

- Create a presentation with the results. Briefly discuss the results per criteria, but focus on the final score. Also briefly discuss the variation in the answers given.
- There is a risk that the discussion will focus too much on methodology. Therefore, focus on finding out why a measure is more appropriate than another measure - not on why a measure got a specific score or on the pros and cons of the methodology.

Finally, the results of the workshop are communicated back to the participants. It is also helpful to describe the results in a case study report, see Appendix E: Template case study report.

# Appendix A: Factsheet Template

| Title of measure | | |
|---|---|---|
| **Current situation**<br>[Description of current situation and the issue] | **Image** | **Impact**<br>[Effects of solution]<br><br>• Costs<br><br>• Accessibility<br><br>• Economy<br><br>• Environment<br><br>• Safety<br><br>• Quality |
| **Solution**<br>[Description of the solution] | | |
| | | **Complementarity**<br>[Interaction with other measures] |
| | | **Sources** |

# Appendix B: SPADE Impacts Glossary

| High-level impacts | Description | Other impacts |
|---|---|---|
| Costs | All financial costs involved in the realisation, operation and maintenance of the measure, including the risk involved. | Infrastructure costs, Investment costs, construction costs, maintenance costs |
| Accessibility | The direct effects of the infrastructure investments. These are mainly effects on travel time, travel costs, travel volumes, and journey reliability. Also the network effects and the hindrance caused by the construction period falls under this category | Journey cost, journey time, journey time reliability, network effect, construction hindrance. |
| Economy | The indirect effect on the production sector, meaning the additional benefits generated by businesses due to the measure. This includes additional sales (due to a more attractive or accessible location), lower production costs or increased production efficiency. This also includes additional employment generated by increased accessibility or the construction period. | Agglomeration effects, labour market effects, tourism, consumer possibilities, operator costs and benefits, induced investments, land value and use, (policy) innovation |
| Environment | This involves pollution from the construction phase and from the use of the finalized measure. There are two main categories of impacts: traffic impacts and environmental area impacts. Traffic impacts are impacts that arise from change in traffic such as noise, local air pollution and global air pollution. Environmental area impacts are impacts that arise in surrounding areas as a result of new improved infrastructure and associated spatial development including impacts on landscape, townscape, biodiversity, heritage and water environment. | Air pollution, noise, vibration, global warming, water quality, solid waste, land contamination, biodiversity, option and non-user value, recreation value, resilience, climate impact, landscape, townscape |
| Safety | Indirect impact on accidents, injuries and fatalities. This also includes the subjective safety, i.e. the perception of safety. | Injuries, causalities, subjective safety, cargo safety |
| Quality | Quality involves other aspects that improve the quality of life of people. These effects are usually referred to as the social benefits. This includes preservation of historic or cultural value, the contribution to social justice and social cohesion, improvements in journey quality or impact on health. | Journey experience, affordability, severance, historical/cultural value, physical activity, social justice, social cohesion, consumer possibilities, affordability, seeting chance |

# Appendix C: Designing the SPADE survey

The suggested way of designing the questionnaire is as follows. The questions are organized per criterion, meaning that the stakeholders are asked to rate each measure for one criterion, before moving on to the next criterion. For each measure, the stakeholders are asked to rate the magnitude of that criterion on a scale from 1 to 7, with 1 being very low and 7 being very high, or 1 being highly negative and 7 being highly positive – depending on the criterion. This is shown in the table below. Key is to define the criterion as clear as possible. If needed, spend three sentences describing each criterion.

Although this is the suggested way, the organiser is free to design the questionnaire according to their preferences. The choice can be made to change the phrasing or to change the number of answering options. For example, a 1 to 5 or 1 to 9 Likert scale can be used. Alternatively, the costs can be estimated quantitatively on a scale from € 100.000 to € 1 billion. However, costs are generally difficult to estimate, so it is recommended to do a qualitative scale.

*Example of survey questions*

| *What are the costs of the measure? The costs includes all financial costs involved in the realisation, operation and maintenance of the measure, including the risk involved.* | | | | | | |
|---|---|---|---|---|---|---|
| Project | Very low | | | Moderate | | | Very high |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Measure 1 | | | | | | | |
| Measure 2 | | | | | | | |
| Measure 3 | | | | | | | |
| *What is the impact of the measures on accessibility, such as journey time, journey costs and journey reliability?* | | | | | | |
| Project | Highly negative effect | | | No effect | | Highly positive effect | |
| | -3 | -2 | -1 | 0 | 1 | 2 | 3 |
| Measure 1 | | | | | | | |
| Measure 2 | | | | | | | |
| Measure 3 | | | | | | | |

Instead of asking the stakeholders for input, the impacts of costs and benefits can be predetermined. Actual numbers can be used (e.g. costs in Euro's, monetized travel time, number of accidents or amount of $CO_2$ emissions) or the size of a cost and benefit could be estimated using on a scale from 1 to 10. This saves time and ensures that already known information is taken into account. For the components for which insufficient data is available, the stakeholders are then asked to make a judgement of the value. It is also recommended to add a 'free text field' next to each question, which allows the participants to motivate their choices.

# Appendix D: The SPADE Tool methodology

In the rating methodology, stakeholders provide ratings for each measurement for different aspects. These aspects compromise the costs and benefits of a measure. Whereas costs are typically a single aspect, the benefits usually consists of multiple aspects, such as the impact on accessibility, environment or safety. An additional benefit is the interaction between the various policy measures. The interaction between the measures is usually filled in by the organiser beforehand, whereas the other aspects are filled in by the stakeholders.

Different scales for the rating can be used, such as the quantitative 5 point Likert scale (very low – very high) or quantitative numbers, such as costs figures or CO2. The final score of the rating methodology is calculated using relative scores, therefore the rating input can have different formats. For the interaction, the measures are given a 1 if the measures strengthen each other, 0 if there is no interaction between the measures, and -1 if the measures exclude each other. Finally, the weights are needed for all benefits, because stakeholders value certain benefits more than others. Weights are usually given by the stakeholders as well.

Once a rating (qualitative or quantitative) has been given on all aspects for each measure, the final score is calculated. The relative rating of each benefit is calculated using the following equation:

$$B = \left( \frac{r - r_{min}}{r_{max} - r_{min}} * m + 1 \right) * w$$

where $B$ is the relative rating of a benefit measure; $r$ the rating of the measure, $r_{min}$ the lowest rating a measure received for the aspect; $r_{max}$ the highest rating a measure received on the aspect; $m$ the interval of the relative differences of the ratings; $w$ the weight of the benefits. Parameter $m$ determines the range of the relative benefits. If less than ten measures are rated, the value $m$ is 4, if ten or more measures are rated, the value for $m$ is 9. The total relative benefits for each measure are calculated as:

$$B_t = \frac{\sum B - \sum B_{min}}{\sum B_{max} - \sum B_{min}} * m + 1$$

where $B_t$ the total relative benefits of a measure; $B_{min}$ the lowest total relative benefits rating a measure received; $B_{max}$ the highest total relative benefits rating a measure received. Since there is only one costs aspect, the relative costs are calculated as:

$$C_t = \left( \frac{c - c_{min}}{c_{max} - c_{min}} * m + 1 \right) * w$$

where $C_t$ the total relative costs of a measure; $c$ the costs of the measure; $c_{min}$ the lowest costs for a measure received; $c_{max}$ the highest costs for a measure $w$ the weight of the costs. If more costs criteria are included, the costs are calculated in a similar way as the benefits.
Finally, the final score of measure $S_i$ is the sum of the total relative costs and relative benefits:

$$S_i = B_t + C_t$$

As an example, let use the following example from one of the case studies of SPADE.
The interaction matrix is as follows:

| Measures | 1. Smart Mobility | 2. Long-term measures for rail | 3. Better Utilization | 4. Deil and Empel 2x4 | 5. 's-Hertogenbosch 2x3 | Total score | Relative interaction |
|---|---|---|---|---|---|---|---|
| 1. Smart Mobility | | | | | | 0 | 1 |
| 2. Long-term measures for rail | | | | | | 0 | 1 |
| 3. Better Utilization | | | | | | 0 | 1 |
| 4. Deil and Empel 2x4 | 1 | 1 | 1 | | 1 | 4 | 2.5 |
| 5. 's-Hertogenbosch 2x3 | 1 | 1 | 1 | 1 | | 4 | 2.5 |
| Total score | 2 | 2 | 2 | 1 | 1 | | |

The costs (mln Euro) and relative costs are rated as follows:

| Measures | Average costs | Relative score |
|---|---|---|
| 1. Smart Mobility | € 49 | 1.0 |
| 2. Long-term measures for rail | € 588 | 5.0 |
| 3. Better Utilization | € 85 | 1.3 |
| 4. Deil and Empel 2x4 | € 477 | 4.2 |
| 5. 's-Hertogenbosch 2x3 | € 242 | 2.4 |

The benefits are scored as follows:

| Measures | Accessibility | Economy | Environment | Safety | Quality | Total |
|---|---|---|---|---|---|---|
| 1. Smart Mobility | 6.9 | 7.0 | 7.4 | 7.4 | 7.1 | 35.9 |
| 2. Long-term measures for rail | 7.2 | 7.3 | 6.7 | 7.3 | 7.2 | 35.8 |
| 3. Better Utilization | 7.6 | 7.2 | 6.7 | 7.3 | 7.3 | 36.1 |
| 4. Deil and Empel 2x4 | 9.1 | 9.4 | 2.6 | 7.8 | 5.6 | 34.4 |
| 5. 's-Hertogenbosch 2x3 | 8.7 | 9.0 | 2.4 | 7.6 | 5.6 | 33.2 |

Translating this to relative benefits yields the following results:

| Measures | Accessibility | Economy | Environment | Safety | Quality | Total |
|---|---|---|---|---|---|---|
| 1. Smart Mobility | 1.0 | 1.0 | 5.0 | 2.0 | 4.5 | **13.5** |
| 2. Long-term measures for rail | 1.6 | 1.5 | 4.4 | 1.0 | 4.8 | **13.3** |
| 3. Better Utilization | 2.2 | 1.4 | 4.4 | 1.0 | 5.0 | **13.9** |
| 4. Deil and Empel 2x4 | 5.0 | 5.0 | 1.1 | 5.0 | 1.0 | **17.1** |
| 5. 's-Hertogenbosch 2x3 | 4.2 | 4.3 | 1.0 | 3.0 | 1.0 | **13.5** |

The weights are as follows:

| Effect | Weight |
|---|---|
| Accessibility | 25 |
| Environment | 20 |
| Safety | 14 |
| Quality | 12 |
| Economy | 9 |
| Costs | 19 |

Finally, the combining the weights with the relative costs and benefits, the final score is as follows:

| Measures | Accessibility | Economy | Environment | Safety | Quality | Costs | Total |
|---|---|---|---|---|---|---|---|
| 1. Smart Mobility | 0.3 | 0.1 | 1.0 | 0.3 | 0.6 | 1.0 | 3.2 |
| 2. Long-term measures for rail | 0.4 | 0.1 | 0.9 | 0.1 | 0.6 | 0.2 | 2.3 |
| 3. Better Utilization | 0.6 | 0.1 | 0.9 | 0.1 | 0.6 | 0.9 | 3.2 |
| 4. Deil and Empel 2x4 | 1.3 | 0.4 | 0.2 | 0.7 | 0.1 | 0.4 | 3.1 |
| 5. 's-Hertogenbosch 2x3 | 1.1 | 0.4 | 0.2 | 0.4 | 0.1 | 0.7 | 2.9 |

As can be seen from this example, the weighting leads to *Better Utilization* scoring best, with *Smart Mobility and Deil-Empel 2x4* right behind it. *'s-Hertogenbosch 2x3* and *Long-term measures for rail* score lower. The measures vary in terms of impact. Some score well on accessibility, while others score well on environmental impact. Measures *Better Utilization* and *Smart Mobility* have low benefits, but because of the lower costs, these are high scoring measures.

It is possible to perform a sensitivity analysis on the results. This can be done in the following ways:

- Add different weights to the criteria

- Add weights to different stakeholders

By performing a *sensitivity analysis*, the organiser can see how the results will change under different scenarios. For example, the organiser can increase the weight for environmental criteria to identify the most environmentally friendly measures. Moreover, the organiser can isolate the perspective of civil society groups by inflating their weights.
Using our example, we redistribute the weights so that the costs are 45% of the weight, with the benefits making up 55% of the weights.

The results for the sensitivity analysis are as follows:

| *Measures* | *Accessibility* | *Economy* | *Environment* | *Safety* | *Quality* | *Costs* | *Total* |
|---|---|---|---|---|---|---|---|
| 1. Smart Mobility | 0.2 | 0.1 | 0.7 | 0.2 | 0.4 | 2.3 | 3.7 |
| 2. Long-term measures for rail | 0.3 | 0.1 | 0.6 | 0.1 | 0.4 | 0.5 | 1.9 |
| 3. Better Utilization | 0.4 | 0.1 | 0.6 | 0.1 | 0.4 | 2.1 | 3.7 |
| 4. Deil and Empel 2x4 | 0.9 | 0.3 | 0.1 | 0.5 | 0.1 | 0.8 | 2.7 |
| 5. 's-Hertogenbosch 2x3 | 0.7 | 0.3 | 0.1 | 0.3 | 0.1 | 1.6 | 3.1 |

As can be seen, the ranking rather similar. *Better Utilisation* and *Smart Mobility* score the highest and lastly comes *Long-term measures for rail*. The infrastructure measures #4 and #5 have switched places. Moreover, differences are larger between the soft-infrastructure measures #1 and #3, and the hard infrastructure measures #4 and #5.

# Appendix E: Template case study report

**1. Case study description**

    1.1.    Background

    1.2.    Objective

    1.3.    Stakeholder analysis

**2. Description of measures**

    2.1.    Measure 1

        2.1.1.   Description of measure

        2.1.2.   Description of effects

    2.2.    Measure 2

        2.2.1.   Description of measure

        2.2.2.   Description of effects

    2.3.    Measure X …

**3. Results**

    3.1.    Description of digital workshop/e-participation

    3.2.    Interaction-matrix

    3.3.    Costs

    3.4.    Benefits

        3.4.1.   Accessibility

        3.4.2.   Economy

        3.4.3.   Safety

        3.4.4.   Environment

        3.4.5.   Quality

    3.5.    Weights

    3.6.    Sensitivity analysis

    3.7.    MCA-CBA Outcome

    3.8.    Stakeholder discussions

**4. Conclusion**

    4.1.    Main results SPADE Tool

    4.2.    Recommendations for the planning process

**CEDR Contractor Report D4.6 / SPADE Guidelines**

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