# Annex 3

# The toolbox method

The design of an SPI depends on a range of considerations, including its aim (see Section 3.1), location and governance (see Section 4.3). The way in which these aspects are managed depends not only on factual circumstances such as the available funding, but also on the normative and epistemological background assumptions of the various SPI members. This includes assumptions regarding the nature of knowledge, the principles of good decision-making, and the relationship between science and society in general. The sum of an actor's assumptions on these philosophical themes constitutes the actor's science–policy model. Although these mental models are not always fully conscious, they can have profound effects on an actor's expectations towards the SPI and on decisions made in the SPI process. Science-policy models are also central to interpreting and implementing the CRELE-IT principles (see Section 3.2).

While their relevance is well documented in the academic literature (Guba and Lincoln, 2000; Van Zwanenberg and Millstone, 2005; Pielke, 2007; Hulme, 2009; Kowarsch, 2016), science–policy models tend to remain implicit in SPI practices. However, there are several reasons why a more explicit approach may be beneficial to SPIs:

- By reflecting their normative and epistemological beliefs, SPI members can gain a better understanding of the pros and cons of various procedural arrangements in the SPI and of different ways to implement the CRELE-IT principles. This can help SPI members to make better informed decisions in the design phase of the SPI process.
- Explicit consideration of science–policy interface models can help to clarify expectations. Studies have shown that normative and epistemological beliefs can vary considerably, especially when actors with diverse professional, cultural, and epistemic backgrounds collaborate (Steel *et al.*, 2004; Reiners, Reiners and Lockwood, 2013; Van der Hel, 2018). Making these assumptions explicit early in the SPI process can prevent unspoken disagreements that may erupt later downstream.
- Explicit consideration of science–policy interface models can also help stakeholders who are not directly involved in the SPI. When the results of these internal discussions are included in the external communication of the SPI, policymakers, practitioners and the public may perceive the SPI as more trustworthy and more legitimate, especially when they feel that the chosen science-policy model resonates with their own values (Elliott *et al.*, 2017).

Several options exist for incorporating such reflection processes into SPIs. The Swiss Academy of Arts and Sciences provides a website[31] where SPI organizers can find various methods with short descriptions and step-by-step instructions (see also Pohl and Wuelser, 2019). Among these methods, the Toolbox Dialogue Approach is particularly well-suited to explore the deep-rooted, philosophical beliefs of actors with diverse backgrounds (Eigenbrode *et al.*, 2007; Hubbs, O'Rourke and Orzack, 2020). The approach demonstrates a positive track record of several hundreds of workshops. Yet it should be noted that the approach has been developed in the context of cross-disciplinarity rather than in an SPI context. Recently, a similar approach has been proposed that does not demonstrate the same track record, but that is specifically tailored to science–policy models (Dressel, 2022).

In the SPI context, a reflection process can be organized along the following steps, which build on the established Toolbox Dialogue Approach and the more recent approach by Dressel (2022):

1. Consider the timing. While a reflection on science–policy models can be useful at any stage of the SPI process, it is advisable to implement it early on. The reflection can be planned around major milestones, such as kick-off meetings or the first gathering of the governing body.

2. Involve the relevant actors. The reflection should include at least the members of the core organizing team and the governing body, but ideally all SPI members and key stakeholders.

3. Choose a format. Both stand-alone workshops and sessions within a larger SPI meeting are possible. The reflection may take anything between two hours and a full day, depending on the group size and the desired depth of the discussion. A professional facilitator is advisable.[32]

4. Structure the reflection. Key elements are:

    a. An introduction on science–policy models (see Section 3.3), including their general characteristics, philosophical assumptions and possible implications on the SPI.

    b. A survey that measures, e.g. on a Likert scale, the participants' agreement with the philosophical assumptions associated with each model (see questionnaire below).

    c. A presentation of the survey results. It should become tangible, ideally by means of illustrative figures,[33] to what degree the group supports each science–policy interface model. A focus should be on agreements and disagreements within the group.

    d. A discussion about these agreements and disagreements. There should be room for participants to give reasons for their preferences.

    e. An optional second survey round. It can be useful to fill out the questionnaire again, measuring whether participants changed their preferences after the discussion.

    f. A final discussion. A key question should be whether the group agrees on a science–policy model, which may well be a hybrid of the models initially discussed, and what this means for the SPI. The practical implications can be debated along the question of how the SPI should implement the CRELE-IT principles.

[31] https://naturalsciences.ch/co-producing-knowledge-explained/methods/td-net_toolbox

[32] In some countries, specialized services for the Toolbox Dialogue Approach are available. Examples include the "Toolbox Dialogue Initiative" at Michigan State University and the "td net" at the Swiss Academy of Art and Sciences.

[33] One way to illustrate degrees of support for science-society models, as well as agreements and disagreements on these models, can be found in Dressel (2022).

5. Plan a follow-up. Further activities may be sensible, especially when the reflection uncovered deeper philosophical disagreements. If there were no strong disagreements, the results can be documented in a collective statement that may later be used to inform external stakeholders about the SPI's underlying science-policy interface model.


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## Questionnaire for a structured reflection on science policy-models.

For each key question, rate the statements A, B and C on a scale from 1 to 5. Consider all statements individually (statements are not mutually exclusive).

Scale: 5 = strongly agree, 4 = agree, 3 = neither agree nor disagree, 2 = disagree, 1 = strongly disagree.

**Key question 1**: What constitutes valid knowledge?

**1-A**: Valid knowledge is based solely on scientific evidence, established scientific methods and standardized peer review.
**1-B**: Valid knowledge is based primarily on scientific evidence, established scientific methods and standardized peer review. Non-scientific sources, such as traditional, local or practitioner knowledge, may be considered to a limited extent.
**1-C**: Valid knowledge is based on both scientific and non-scientific sources. Data from traditional, local or practitioner sources must be considered in addition to scientific evidence, established scientific methods and standardized peer review.

**Key question 2**: What is the proper role of value judgements in the process of knowledge production?

**2-A**: Value-judgements can and should be excluded from the process of knowledge production.
**2-B**: While it may not be possible to exclude value-judgements completely from the process of knowledge production, their influence should at least be minimized.
**2-C**: Since excluding value-judgements is neither possible not desirable, they have a legitimate place in the process of knowledge production.

**Key question 3**: How should scientists and other knowledge holders treat uncertainty?

**3-A**: While knowledge is rarely perfect, we can be confident that uncertainty will be minimized by advances in knowledge. The best response to uncertainty is therefore more and better research.
**3-B**: Uncertainty is an important feature of knowledge. Since uncertainty will never be eliminated completely, the best response is to continue research, but to avoid overconfidence.
**3-C**: Knowledge is inherently uncertain. While future research may be helpful, the best response to uncertainty is to invite stakeholders to evaluate and improve the existing knowledge.

**Key question 4**: How should scientists and non-scientists relate to each other in the process of knowledge production?

**4-A**: Knowledge production should mainly be driven by scientists. Non-scientists may be consulted occasionally, but scientists should have full authority due to their expertise.
**4-B**: Non-scientists should be consulted regularly by scientists to understand the needs of practice. However, scientists should remain in charge when it comes to data and evidence.
**4-C**: Non-scientists are as important in knowledge production as scientists. They should engage in an open and equitable dialogue where scientists and non-scientists enjoy the same authority.

**Key question 5**: What is the proper relation between knowledge and other decision factors in policy?

**5-A**: A solid knowledge base is the most important factor for good policy. Other factors, such as political or ethical considerations, should play a secondary role.
**5-B**: Good policy rests on many factors, including political or ethical considerations. While knowledge is relevant as well, its influence should not be overestimated.
**5-C**: The line between knowledge and political or ethical considerations is blurry. Rather than assuming a hierarchy, these factors should be seen as equally important for good policy.

**Key question 6**: Should scientists and other experts advocate for or against specific policies?

**6-A**: Scientists and other experts should improve policy by advocating for the best course of action. Policymakers and the public should pay special attention to their advice.
**6-B**: While scientists and other experts should provide policy-relevant knowledge, they should remain politically neutral, as they are not legitimized to prescribe courses of action.
**6-C**: Scientists and other experts are as legitimized as everyone else to advocate for or against specific policies. Their advice is valuable, but does not carry any special authority.

**Key question 7**: What makes a decision-making process legitimate?

**7-A**: A decision-making process is legitimate if it generates good policies. The legitimacy of such a process is based mainly on the quality of the resulting decisions.
**7-B**: A decision-making process is legitimate if the involved decision-makers are properly authorized. Legitimacy depends mainly on whether those making a decision are entitled to do so.
**7-C**: A decision-making process is legitimate if all stakeholders had an opportunity to contribute to the process. Inclusion of all affected parties is the main source of decision legitimacy.

**Key question 8**: What type of boundaries exist between science, politics, and other societal sectors?

**8-A**: Science, politics, and other sectors are distinct societal spheres. Interaction between these spheres is most effective when scientists take the initiative by speaking truth to power.
**8-B**: Science, politics, and other sectors are distinct societal spheres. Effective interaction occurs when decision-makers take the initiative by defining a problem and requesting the specific knowledge required to solve it.
**8-C**: The boundaries between science, politics, and other sectors are fluid. The most effective mode of interaction is a continued dialogue where all sides can take the initiative.

Analysis: For each key question, statements A, B, and C represent the background assumptions associated with one science-policy model discussed in this guidance (see section 3.3). Key questions 1, 2, 3 and 4 focus on epistemological assumptions; key questions 5, 6, 7 and 8 focus on normative and socio-theoretical assumptions. The sum of a respondent's ratings in either of these categories describes the degree to which the respondent subscribes to the respective model. Results can be analyzed on an aggregated basis to determine the group's overall support for each model, or on an individual basis to determine discrepancies and convergencies between participants.

Statement categories: A = production-focused model, B = policy-oriented model, C = integrated model

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