Participatory foresight for technology assessment
Towards an evaluation approach for knowledge co-creation

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Technology assessment (TA) frequently uses forward-looking methods to anticipate socio-technical changes and their corresponding implications to deduce advice for policy and society. In recent years, participatory methods have increasingly been applied to identify the expectations of society towards future technologies. In this context, several TA projects have developed, applied and adapted a participatory foresight method to engage citizens as well as other actor groups into co-generating advice for research and innovation agenda setting in a standardized process; namely, the multi-perspective and multi-step CIVISTI method (Citizens’ Visions on Science, Technology and Innovation). Over the course of the past ten years, about 560 lay citizens with out specialised knowledge on technology and innovation and 610 experts and stakeholders have taken part in these processes of co-generation of knowledge. In this contribution, we use our experience with this method and elaborate some criteria for the evaluation of knowledge co-generation and mutual learning in participatory foresight processes within TA.

Partizipative Foresicht für die Technikfolgenabschätzung
Hin zu einem evaluationsgestützen Ansatz für die Wissensko-Generierung


Keywords: technology assessment, participatory foresight, co-creation of knowledge, mutual learning, evaluation criteria

Introduction and background

From the perspective of futurists and foresight practitioners, participatory foresight is seen as one possible way to provide a greater variety of perspectives and ensure certain “knowledge encounters” within the foresight process (Nikolova 2014). TA, however, has developed participatory foresight methods to assess different expectations of future technologies for the shaping of technology and innovation policy. Polk and Knutsen (2008, p. 644) argue in favour of “[…] establishing trans-disciplinary platforms for knowledge production. Goals and visions are jointly created via participation and mutual learning, rather than by assigning science and technology the burden of producing the certainty that is demanded by political and economic rationality”. Here, there is a focus on multi-actor governance by posing the question of what targets future socio-technical developments and thus their framework conditions should be aimed at. Therefore, participatory foresight in TA is increasingly oriented towards processes of knowledge co-generation between different actor groups.

The terms co-creation, co-production and co-generation are often used synonymously in literature in various fields, while being closely connected to concepts of public engagement, open innovation or inclusive governance (Regeer and Bunders 2009;
knowledge, e.g. citizens’ visions, results from analysis of visions regarding values and needs, experts’ and stakeholders’ recommendations or their validation and prioritization through citizens (Gudowsky and Sotoudeh 2017). While citizens’ visions remain in their original state, all subsequent steps not only refer to them, but built upon them and thus a transformation of knowledge takes place. The optimization of these special participatory processes for foresight in TA and the evaluation processes should therefore consider not only the mechanisms of information exchange and communication between society, science and policy in participatory TA (pTA) or quality factors such as fairness, transparency and efficiency for internal and external legitimacy of processes and results (Rower and Frewer 2005; Joss and Bellucci 2002), but also the knowledge exchange and generation in a multi-actor foresight processes. With regard to CIVISTI, different types of knowledge are elicited in different steps of the process, and are interlinked and transformed through various analytical and participatory steps of the method (Jacobi et al. 2010; Gudowsky and Sotoudeh 2017). Engaged actors in the CIVISTI cases discussed in this contribution remained spatially and timely separated, and thus one could argue that no true co-creation took place. However, the resulting final products display co-generated knowledge as stated above. Here, a systematic insight into the co-generation of knowledge in participatory foresight methods could improve the structuring of inter- and transdisciplinary work and actively promote the uptake of results into technology and innovation policy. Finally, we will suggest an extension to the evaluation of participatory foresight processes for TA for optimization of the co-generation process.

In order to analyse the co-generation process, we need a distinction between different types of knowledge and their interactions during co-generation. A detailed analysis of these processes is beyond the scope of this contribution. We present an analysis based on an initial selection of different knowledge types for co-generation and distinguish between three categories for the characterization of knowledge in participatory foresight in TA:

a) In the first category, actor-specific knowledge is pointed out. The evaluation process should be sensitive to interactions of actor-specific views and perspectives during the co-generation of knowledge. Nowotny (2003) has emphasised the need for generating socially robust knowledge and bringing together the many different knowledge types and dimensions (see also Pohl and Hirsch-Hadorn 2006). This category addresses who contributes to co-generation and how different perspectives are involved.

b) The second category supports distinctions between different types of knowledge for decision-making by participatory foresight for technology policy. For this analysis we distinguish between four relevant types of knowledge within this category: cognitive knowledge (e.g. based on different actors’ perspectives on scientific and technological issues for the analysis of arguments and decision making) and pragmatic dimensions of knowledge based on political culture and the question of power to influence decision-making processes. Cognitive and pragmatic knowledge are components of scientific knowledge (Kuznetsov et al. 2012, p. 880). Knowledge of normative values (rooted in social norms, cultural identity of participants, etc.) is relevant for this analysis, in the context of transdisciplinarity. Scientific analysis for the multi-dimensional characterisation of potential impacts of suggested future solutions should be linked with normative knowledge as a prerequisite for determining the acceptability of solutions. Remm (2009, p. 565) describes the need for normative orientation knowledge for risk management for a sustainable development. The relevance to distinguish cognitive, normative and pragmatic dimensions in decision making procedures in pTA has been highlighted with regard to “inequality”¹ in Belluci et al. (2002, p. 22). For our purposes, we apply this threefold distinction to different dimensions of knowledge. For an analysis of knowledge co-generation within participa-

¹ “A cognitive dimension, which reflects different actors’ perspectives on scientific and technological issues […], a normative dimension, reflecting the plurality of (possibly conflicting) norms and values […], a pragmatic dimension, reflecting the unequal distribution of institutionalised or informal influence on decision-making processes” (Belluci et al. 2002, p. 18).
tory foresight in TA, we consider also “emotional knowledge” based on hopes and concerns of individuals: “Emotional knowledge is created by emotions and integrated together with cognitive knowledge into our mental representation of the world.” (Brătianu and Orzea 2014, p. 43)

In the third category, long-term planning in participatory foresight in TA is framed through systemic knowledge. Target knowledge and transformation knowledge. Systemic knowledge (knowledge about what is) is knowledge of the complex interrelationships of present problems of everyday life on a social, ecological and economic level. Target knowledge is about evaluation and description of future state (knowledge about what should be and what should not be). It is knowledge about how standards can be justified. Transformation knowledge is about how to get from the existing to the target state and how the transition from the current to the target state is to be designed and implemented (see Dubielzig und Schaltegger 2004).

We will show the role of different knowledge categories on an example, namely the CIVISTI method (Citizens’ Visions on Science, Technology and Innovation), since the process of knowledge co-generation was taken into account in the design of the CIVISTI method. The method has been developed and applied on regional, national as well as supra-national (EU) levels since 2008 to co-generate knowledge on societally relevant issues for target setting for research and innovation policies and programmes. The process of communication and deliberation as well as results are published and provide our knowledge pool for this analysis of co-generation of knowledge within participatory foresight in TA (see Sotoodeh et al. 2014; Gudowsky et al. 2012; Gudowsky and Peissl 2016; Gudowsky and Sotoudeh 2017; Gudowsky et al. 2017). The next section provides an overview of the transdisciplinary foresight method CIVISTI.

**Introduction to the CIVISTI method**

CIVISTI proceeds in three main steps. step one: generation of citizens’ visions; step two: generation of experts’ recommendations based on citizens’ visions; and step three: validation of recommendations by citizens. Step 1 involves a diverse range of background knowledge of citizens and is framed to provide target knowledge through their visions for desirable futures, which are then analysed by experts and stakeholders in step 2. This step is framed for using experts’ systemic and transformation knowledge in order to identify underlying societal expectations. Citizens’ visions aim to include expectations (hopes and concerns as emotional knowledge for decision-making) in a standard vision format – of about one page of text including a short description of a desirable future in about 40 to 50 years and dealing with concerns, hopes and reflections on possible positive and negative impacts of this future. These visions are the basis for experts’ and stakeholders’ cognitive analysis to decide on recommendations for research programme development, which are afterwards returned to the citizens for evaluation and prioritisation (step three of CIVISTI).

In Table 1, we compare the first two steps, which are as mentioned, mainly responsible for the co-generation of knowledge and are the focus of this contribution. The third step, which is less standardised than the first two, is a reflection of the expert evaluation by the citizens.

The CIVISTI method has been developed and applied during the last ten years in a number of EU and nationally funded projects in different scopes (see Table 2).

The CIVISTI method is based on a commitment to the inclusion of society and deliberation on targets for technology and innovation policy, in order to respect the diversity of opinions and perspectives, the willingness of politics, business and society to think out of the box for the transformation of socio-techni-

<table>
<thead>
<tr>
<th>CIVISTI Citizens’ visioning workshops (step 1)</th>
<th>CIVISTI Stakeholders’ and experts’ workshops (step2)</th>
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<tr>
<td>Framing role for long-term planning (knowledge category c)</td>
<td>Co-generation of target knowledge with citizen participation</td>
</tr>
<tr>
<td>Time horizon for ideas</td>
<td>40 to 50 years</td>
</tr>
<tr>
<td>Participants</td>
<td>Heterogeneous group of citizens</td>
</tr>
<tr>
<td>Input information</td>
<td>Prompting material to inspire citizens thinking about future</td>
</tr>
<tr>
<td>Expected outputs*</td>
<td>Visions (desirable futures) with focus on emotional knowledge</td>
</tr>
<tr>
<td>Addressees</td>
<td>A broad spectrum of actors including experts, stakeholders, citizens and policymakers in different fields.</td>
</tr>
<tr>
<td>Application of results</td>
<td>New input on societal needs into research programmes and policy debates</td>
</tr>
</tbody>
</table>

* CIVISTI is designed to focus on different types of knowledge for decision-making in category b at different steps. **Tab. 1:** Two different workshop types in the CIVISTI method. **Source:** own compilation
CIVISTI follows the first strategy and starts with a fair and inspiring lay visioning process. The citizen panels have been homogeneous in terms of the national or local context and heterogeneous in terms of age, education, gender, occupation, etc. In this way, it is possible to use the advantages of a minimum level of common cultural background and at the same time to promote individual openness to cooperation, since the participants are interested in discussions on future and are not invited as representatives of a special group. Framing the process for a long-term perspective to look 40 to 50 years into the future, citizens are inspired to think out of the box and focus on target knowledge (Table 1) without any experts present. The diversity of citizens for a panel based on different experiences has a strong influence on the quality of discussion. Different authors report that “Participants in dialogue speak and listen with mutual authenticity and openness, seeking to understand and learn from each other’s experience and perspective without refuting the legitimacy of divergent views” (Abdel-Monem et al. 2010, p. 748).

The evaluation report of the first citizens’ visioning workshops in CIVISTI in 2008 shows clearly that the majority of citizens had a very positive view of the fairness of the discussion and the creative environment for thinking out of the box. Later experiences confirmed this (Bedsted et al. 2017).

Fostering creativity through inspiring elements in lay-visioning

The design of the visioning process encourages citizens to start with emotional knowledge (Table 1) and develop visions in a step-by-step, moderated, inspiring process (Table 3). The visioning workshops are usually conducted in one or two days depending on the scope of the case study.

<table>
<thead>
<tr>
<th>CIVISTI-based Projects*</th>
<th>Years</th>
<th>Scope</th>
<th>Scale</th>
<th>No. of Citizen Visioning Workshops</th>
<th>No. of citizens</th>
<th>No. of Visions created</th>
<th>No. of experts and stakeholders</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIVISTI</td>
<td>2008-2011</td>
<td>Research programme development for Horizon 2020</td>
<td>EU 8 countries</td>
<td>8</td>
<td>200</td>
<td>80</td>
<td>30</td>
</tr>
<tr>
<td>CIVISTI-AAL/Leben2050</td>
<td>2013-2014</td>
<td>Consulting for City development, autonomous ageing in future cities</td>
<td>Regional: City of Vienna</td>
<td>1</td>
<td>50</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>Future Foods 4 Men &amp; Women</td>
<td>2014-2016</td>
<td>Research programme development for the Austrian Agency of health and food safety</td>
<td>National: Austria</td>
<td>5</td>
<td>90</td>
<td>50</td>
<td>30</td>
</tr>
<tr>
<td>CASI</td>
<td>2015-2017</td>
<td>Framework for assessment of social and technical innovations</td>
<td>EU 12 countries</td>
<td>12</td>
<td>226</td>
<td>50</td>
<td>500</td>
</tr>
</tbody>
</table>

* The EU-funded project CIMULACT (www.cimulact.eu) is based on the CIVISTI method, but its method differs considerably and it is therefore not considered here.

Tab. 2: Overview of a number of workshops and participants in different CIVISTI-based projects. Source: own compilation
Observation of the CIVISTI workshops has shown that citizens focus sometimes not only on emotional knowledge, but also on pragmatic, normative or cognitive knowledge for decision-making (category b). In such cases or also, when they focus on transformation knowledge instead of target knowledge (category c), it reduces the condition of thinking out of the box. One of the observed difficulties of the last step is that citizens reduce sometimes the creativity of their ideas at the end of the workshops, since they repeatedly fall back to thinking in terms of feasibility based on pragmatic and cognitive knowledge. A success factor for the facilitation of the visioning process is the promotion of creativity during the whole visioning process and reduction of focus on economic advantages or perceived feasibilities. As an example: citizens who generated a story with the wish for new multi-generational living concepts in the city in the Leben2050 project started to reduce the creativity of their visions and the focus on their emotional knowledge as soon as they discussed the costs of such processes for the whole city. Here, they were going to leave the borders of the step 1 and enter the step 2 of the process (Table 1). As citizens’ creativity was reduced by thinking about feasibility, facilitators suggested they could think about possible financial aid in 40 years and continue to work on specification of the new living models of the future. Citizens then discussed different new ideas in order to fulfil their daily needs and to be happy in the new living concepts. Here, the focus was on the emotional dimension (a sub-category of knowledge category b). Citizens were informed that experts and stakeholders were responsible for considering feasibility analysis for the next 20 years based on systemic and transformation knowledge and focus on cognitive knowledge (Table 1). Finally, experts could identify the need of social integration and the concern of social isolation as a core issue in different visions. They could define a number of feasible measures\footnote{Transformation knowledge for long-term planning (category c), pragmatic dimension (category b).} such as design of real life meeting spaces in addition to ambient assisted technologies in new living concepts to “avoid social isolation of older adults”. The latter issue is based on normative dimension (category b), which should be avoided to reduce social divide.

After this short example of involvement of different knowledge categories within CIVISTI, the next section discusses the application of knowledge analysis for evaluating the quality of the process and results of knowledge co-generation.

**Towards criteria for evaluating knowledge co-generation for CIVISTI-based case studies**

For the evaluation of knowledge co-generation, one important factor is the separation of roles of actors. CIVISTI is designed for clear roles of citizens within the lay visioning process and also between citizens, stakeholders and experts. The separation or combination of actors’ roles in the visioning process influences lay-visioning. If, for example, experts and stakeholders are chosen intentionally or inadvertently during recruitment to join the visioning process (workshops), they influence the results with their expertise.

For strategic planning, it is of utmost importance to strengthen citizens’ roles as visionaries to elicit wishes and concerns for the future, while keeping their focus away from everyday systemic knowledge (e.g. today’s newspaper headlines). The contribution of citizens to transformation knowledge is separated from the visioning step to avoid feasibility thinking reduce their creativity.
At the same time experts are asked not to develop their own visions while analysing and transforming citizens’ visions in the recommendations. Evaluating knowledge co-generation should closely observe if the role separation has been successful (see also ZSI 2011). Nevertheless, citizens should be able to provide their knowledge on feasibility to the third step of the co-generation process for the validation of recommendations (see introduction to the CIVISTI method).

In comparison to the citizens’ focus on emotional expectations in visions, the CIVISTI process is designed so that the stakeholders and experts analyse citizens’ visions mainly based on their cognitive and pragmatic considerations including problems, improvements in development of participatory foresight methods as well as a clear understanding of the knowledge co-generation process.

The suggested focus on the role of different categories of knowledge at different steps of the participatory foresight processes supports structural transparency and should be discussed during the design and implementation of the processes as well as the analysis of results. It should help to develop more precise facilitation concepts according to a higher level of awareness on required contributions at each step and it could support better insight to the quality of results of the participatory foresight in TA.

As an example, in CIVISTI we should be sure, if citizens from different backgrounds could generate new knowledge based on their own hopes, concerns and everyday experiences regarding a desirable future, or if stakeholders and experts have influenced the visioning process through presentations, moderation, etc. Therefore, the evaluation approaches should consider, whether actor-specific roles have been explicitly defined and taken into account for knowledge co-generation.

Further questions for CIVISTI are whether the focus of citizens is on target knowledge, as planned, and whether the stakeholder and experts’ workshops focus on systemic and transformation knowledge according to the design of the process. Therefore, in future, we will distinguish explicitly between different dimensions of knowledge and knowledge hierarchies for the design of facilitation concepts and evaluation of knowledge co-generation in CIVISTI-based case studies.

A closer look into knowledge co-generation is also useful for other participatory foresight methods in TA. In this way, we hope to be able to identify weak points of the knowledge co-generation from a new perspective and also to achieve improvements in development of participatory foresight methods in TA.

**Conclusion**

Assumptions about participation are often rooted in 20th century, expert oriented culture of thinking. We observe a need for more spaces where individuals can enter into profound discussions about concerns and hopes for the future of the environment, economic development and a just society.

New creative participatory foresight processes in TA could be milestones for a transformation towards the institutionalisation of future-oriented knowledge co-generation able to deal with grand challenges. Fostering creativity and conducting the visioning process in a fair democratic environment can serve as a valid inclusion of laypeople in agenda setting, and therefore increase legitimacy and accountability of research and innovation agendas. For evaluation of participatory foresight processes in TA there is a need for both standard criteria for evaluation of public participation such as fairness, transparency and efficiency as well as a clear understanding of the knowledge co-generation process.

CIVISTI emphasizes the early inclusion of lay people’s knowledge into target and priority setting for research and innovation by means of creative visioning.
References

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Research Data


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