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RESEARCH ARTICLE

Citizen participation in the long-term process of high-level radioactive waste disposal: Future tasks and adequate forms of participation

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Abstract • The central importance of public participation in the search for a repository site for high-level radioactive waste is already recognized both in Germany and in other countries. In this paper, we argue that public participation will have to play a role after site selection as well, especially in the political and sociotechnical decisions in the next stages of the final disposal process. The form of citizen participation should correspond to the specific tasks and follow the principles of safety and justice. In order to show in which cases these principles apply and which form of participation would then be appropriate, we analyze three aspects of participation (co-determination, co-design, and involvement) and look at two cases: the decision on the sealing of the repository and the design of compensations.

Bürgerbeteiligung im langfristigen Endlagerungsprozess:* *Künftige Aufgaben und angemessene Beteiligungsformen

Zusammenfassung • *Die zentrale Bedeutung der Öffentlichkeitsbeteiligung bei der Standortsuche für ein Endlager für hochradioaktive Abfälle ist sowohl in Deutschland als auch in anderen Ländern bereits anerkannt. Wir vertreten in diesem Beitrag die These, dass Bürgerbeteiligung auch nach der Standortentscheidung eine Rolle spielen sollte, insbesondere bei den politischen und soziotechnischen Entscheidungen in den nächsten Etappen des Endlagerungsprozesses. Die Form der Bürgerbeteiligung sollte den konkreten Aufgaben entsprechen und auf den Prinzipien Sicherheit und Gerechtigkeit beruhen. Um zu zeigen, in welchen Fällen diese Prinzipien Anwendung finden und welche Beteiligungsform dann angemessen ist, analysieren wir drei Aspekte von Beteiligung (Mitbestimmung, Mitgestaltung und Mitwirkung) und betrachten dazu zwei Fälle: die Entscheidung über den Verschluss des Endlagerbergwerks und die Kompensationsmaßnahmen.*

Keywords • *participation, high-level radioactive waste, compensation, justice, safety*

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On the adequacy of participation techniques

Public participation in the long-term process of final disposal of high-level radioactive waste (HLW) has been already explored: concerning its type and extent in accordance to the purpose of the involvement and the stage in the decision-making process (Krütli et al. 2010), exploring the requirement of a learning process and its implications for the institutional actors involved (Brohmann et al. 2021) and considering particular requirements for a successful long-term governance, like place-attachment of the people at the repository site (Mbah and Kuppler 2021). In order to assess the role and modes of participation in the stages of the process after the site selection, our analysis mainly relies on the challenges posed by the characteristics of the problem itself. As Kamlage et al. (2019) argue, the ambitious participatory approach in the current search for a repository site in Germany emerged as a response to challenges posed not only by the failed attempt at Gorleben, but also due to the characteristics of the problem of radioactive waste disposal and its governance system.

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The final disposal of radioactive waste is a complex and highly contested sociotechnical problem (Brunnengräber 2016; Ramana 2019). Its solution does not arise from a scientific or technical point of view alone. It also requires the involvement of different societal actors (Röhlig 2022; Brunnengräber and Di Nucci 2019; see also Skorupinski and Ott 2000) whose knowledge, interests and values are at stake. It also involves a political decision-making process since science alone cannot identify the single very best site. Political decisions in a democratic system, on its turn, require citizen participation at different levels if citizens are expected to endorse them and to identify with corresponding policies (Lafont 2020).

It is easy to claim and hard to refute that participation is inadequate if the underlying concept of adequacy remains undefined.

Under the general agreement that there should be public participation, there still may be disagreement between participants and process-owners (Krütli et al. 2010, p. 863) about the modes and forms that are (in)adequate at different stages of the disposal process. In the present stage, strong disagreement has led to protest and withdrawal from the process in Germany (Boettcher et al. 2021; Themann et al. 2021). To determine which form is 'adequate' is, however, wicked; it is easy to claim and hard to refute that participation is inadequate if the underlying concept of adequacy remains undefined.

The dynamic-functional approach assesses the adequacy of participation techniques based on a typology of participation forms and the requirements at different stages of the decision-making process (Krütli et al. 2010). In our contribution, we consider that additionally the adequacy-relation should be specified as well. To that end, we first examine different aspects of participation and then illustrate the idea of adequacy on the basis of two future tasks within the process of final disposal.

Three forms of participation

Our approach to participation follows a theory of deliberative democracy (Habermas 1992) as it has been specified in the concept of "environmental deliberative democracy" (Ott 2014, p. 291) and the "participatory conception of deliberative democracy" (Lafont 2020, p. 7). Both concepts offer important distinctions for situating the kind of participation that we want to stress in democratic decision-making processes.

Following Habermas, the concept of environmental deliberative democracy distinguishes between a) the core of the political system that has sufficient democratic input-legitimacy to make collective decisions with long-term consequences, b) a reasoning civil society, and c) an intermediate deliberative zone. Within this zone, committees, boards, academies, state authorities, think tanks, and representatives from science, trade-unions, churches etc. are involved in deliberative settings (Ott 2014, p. 225). Through participatory formats, citizens can take an active role within this intermediate zone. Such role is additional to the formally regulated options of political engagement either in civil society or by voting at elections. It is also additional to the governance processes within the core of the political system that involve local and federal authorities. This additionality must be taken into account when considering the appropriateness of formats. Participation enriches the role of citizenship in the intermediate zone, apart from the role of citizenship in civil society and as a voting electorate. Furthermore, participation may have some intrinsic value, but it has to be embedded in democratic ways of problem solving and not just be 'maximized' without further considerations.

From the point of view of participatory deliberative democracy, participation in decision-making processes corresponds to the capacity of citizens to effectively shape the policies to which they are subject so they can endorse them as their own (Lafont 2020, p. 2). The key aspect of participation is its contribution to the "macro-deliberative processes of opinion- and will-formation in the broader public sphere" (Lafont 2020, p. 31). The distinction between deliberation processes at the macro level, on the one hand, and deliberation at the micro and local levels, on the other hand, characterizes the concept of participation: Public participation in macro-deliberative processes is an essential component of the democratic ideal of self-government, the idea that citizens shape the policies to which they are subject. The aim at this level is maximal inclusion in deliberation. Approaches to participation at the other two levels have other purposes in mind: Improving the quality of micro-level deliberations, e.g., through participation in mini-publics, and strengthening problem-solving capacity at the local level through citizen participation (Lafont 2020, pp. 31–32).

In an analysis of fair democratic processes, two aspects of participation have been distinguished: participation as the greatest possible involvement of affected parties in a discussion and participation as the possibility of contesting and shaping the discussion agenda (Benhabib 2016, p. 213). If participation is a necessary condition for a fair process in the siting of radioactive and other types of repositories (Young 1983; English 1991), then Benhabib's distinction applies: One should have broad participation and participants should be entitled to shape the agenda. Sometimes it has been claimed that participation also should include final decision and veto power. Research on site selection processes shows, however, that participation as decision power is not seen by stakeholders as a necessary condition

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for a fair procedure. Decision-making power is less important than transparency and access to information, as the selection process for a repository in Switzerland shows (Krütli et al. 2015, pp. 135–136). In the broader context of procedural justice, participation has been understood as "voice," i. e. as the possibility of presenting one's point of view within a decision-making process (Meyerson et al. 2021, p. 5) sometimes with the expectation of influencing the outcome (Schmidt 2018, p. 175). This last aspect is also stressed in the participatory approach of deliberative democracy (Lafont 2020, p. 32).

We want to complement the previous outline with a result from an interdisciplinary discussion on participatory aspects of procedural justice held at the workshop 'Ein faires und inklusives Verfahren?'. The workshop is part of the project Transdisciplinary Research on High-Level Radioactive Waste Management in Germany (TRANSENS) and took place at the University of Kiel in November 2021. The discussion on procedural justice was structured through the dialogue method 'Open Space Dialogue'. In the discussion, three German terms were associated with the meaning of participation. The result was the specification of the terms with reference to three elements in decision-making: preparation, process and outcome. However, unlike the 'ladder' conception of citizen participation (Arnstein 1969), the specification does not stress the higher or lesser degree of participants' decision power, but rather point out their involvement with respect to the (decision-making) *process*, its *outcome* and its *preparation*. This specification allows us to link the definitions presented above with those elements, making the following distinctions more suitable for our analysis of adequate participation forms in decision-making in the German final disposal process:

‚To have a say' ('mitbestimmen') is ambiguous, as it might refer to having real decision and veto power or just having the entitlement to present arguments in order to create an influence on the decision. In German language 'bestimmen' implies a capacity to decide as in, e.g., 'Hier bestimme ich!'. A way to resolve this semantic ambiguity is by drawing a distinction between a strong and a weak version. In the strong version, 'having a say' refers to the decision outcome and implies decision power (Young 1983, English 1991). In the weak version, it refers to the decision-making process and just means a real chance to present one's arguments in a deliberative setting, being close to the conception of participation as 'voice' (Meyerson et al. 2021).

‚To jointly shape' ('mitgestalten') refers to the deliberative decision-making process and not to the decision outcome, like in the weak sense of 'having a say'. It can be defined as taking up a point (an opinion, a statement or an argument) and reflecting upon it, in order to obtain something shared from it. Jointly shape means, thus, to reflect upon arguments being made in order to proceed to a commonly shared decision. In its deliberative sense, to jointly shape is similar to the understanding of participation in participatory deliberative democracy (Lafont 2021). Going beyond this understanding, it entails formal involvement in the decision-making process, not only the deliberation processes in the public sphere.

‚Being involved' ('mitwirken') refers, as in the case of jointly shaping, to the deliberations within the intermediate zone prior to the decision-making process and not to the decision outcome. Unlike jointly shaping, it does not entail formal involvement in decision-making, but rather involvement in the preparation of the decision-making process in formal and informal deliberation processes ("Entscheidungsvorbereitung"; Ott 2014, p. 296). It is discursive involvement in processes of finding solutions within the intermediate zone.

Participation in the stages after the site selection: two future tasks

As mentioned earlier, there are several approaches to evaluating the role and form of citizen participation in the long-term process of radioactive waste disposal. We agree with Krütli et al. (2010, pp. 863, 865) on the importance of examining the adequate 'type and extent' of participation for each stage of a decision-making process and considering the 'issue at hand', instead of just aiming for maximum inclusion. The modes of participation in future stages of the final disposal in Germany (KLA 2016, p. 252) will thus correspond to the particular tasks in a given stage. We now explore the task of compensating for possible harms and burdens during construction and operation (stages two and three) and the task of sealing the repository (stage five).

Decision on compensatory measures

After deciding on the location, the host community is selected as the one that lives at the site with the "best possible safety"[1]. If an adverse impact would affect the safety of the repository, immediate action would be taken to restore a safe condition. The case for compensation, however, remains even if the site is safe in technical terms. It supposes that local people are negatively affected by the overall process of constructing and governing a repository, or by its mere presence. This includes, e.g., noise, property damage, all kinds of political trouble, or bad reputation for the host community. Thus, the damages and burdens to be compensated do not include the risks of radioactive contamination, but only noise and property issues in terms of civil law and property law.

Negative impacts on the economy, the development perspectives and the quality of life of the population will be also compensated. In the siting process in Switzerland compensations ('Kompensationen') are carefully distinguished from payments ('Abgeltungen') that will be negotiated between the repository host community and the responsible for waste disposal as recognition for contributing to solve a national problem (BFE 2017, p. 3).

1 Repository Site Selection Act of 05. 05. 2017 (BGBl. I p. 1074), as last amended by Article 1, Section 2 of the Act of 07. 12. 2020 (BGBl. I p. 2760). Available online at https://www.gesetze-im-internet.de/standag_2017/StandAG.pdf (in German), last accessed on 17. 10. 2022. Cited below as StandAG.

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In the German case, such a distinction is implied, but there is not yet a defined term for the benefits that will be part of the Site Agreement. In the ongoing search for the repository site, it is planned to analyze which impacts a repository could have in the potential host communities that will be proposed in phase three of stage one for underground exploration. The socioeconomic potentials analysis will then offer a basis for the Site Agreement[2]. There, a plan for regional development to offset possible negative impacts on the host community should be already included.

A series of questions have to be specified concerning compensation measures, e.g., what exactly will be offered to whom and for how long. Defining which persons exactly count as being affected is not a simple matter since any definition will be arbitrary. Shall only persons in the host community count as being affected or also those in its surroundings? Should political units or mere distance to site be decisive? However this might be decided, the appropriate form of citizen participation in the case of determining what will be offered and how it will be used is the granting of decision power to those being affected. The argument relies on the notion of fair compensation itself. If a claim for compensation has been accepted, and if there are different options to fulfill this claim (money, resettlement, infrastructures etc.), and if the general principles of participation and deliberative setting ('jointly shape') are taken seriously in cases of compensatory justice, then it follows that the burden bearers should decide which compensation they prefer. If a burden X shall be compensated by either A, B, or C, and if A, B, and C are equally costly for the compensatory agency, and if the burden bearer prefers A over B and C, there are no reasons why the agency which takes the responsibility for the burden, should be entitled to decide against the preference of the burden bearer. From the perspective of the burden bearers, B and C would count as 'under-compensation.' For political reasons, there could be protests if a non-preferred option is forced on people affected by the burden.

At the transdisciplinary workshop 'Finanzieller Ausgleich für ein Atommüll-Endlager', held in Karlsruhe, Germany from 06 to 08 May 2022, we have proposed to engage citizens in discussions concerning compensations by means of the evaluation of compensation models and the development of new models on this basis. Beside the traditional models of direct payments or infrastructure development, the models of social or community benefits (Richardson 2010, p. 5; Lehtonen and Kojo 2019), the added value approach (NEA 2015, Kojo and Richardson 2019) and "postmaterialistic offers" (Ott and Riemann 2018, p. 54) appear as more suitable for developed regions. Compensation measures refer, in this sense, to novel kinds of prosperity and quality of lives at a site. At the workshop we took a first step towards developing compensation models: Two separate groups worked on basic aspects of compensations using the first two steps of 'Soft Systems Methodology'. Both groups included researchers, stakeholders and citizens. The results are still being assessed, but we want to stress here the relevance of the exercise: through work group, participants gained a more differentiated insight on basic aspects besides the type of burdens, e.g., the affected parties, the responsible parties, the possible ways of offsetting the burdens as well as possible limits or restrictions to this offsetting. Preliminary results show that from the participant perspective the concept of 'offsetting' and its possible limits need special attention. Compensation measures that really improve the situation in the host community of a repository have thus to include the perspective of that community.

The damages and burdens to be compensated include not only the risks of radioactive contamination, but also noise and property issues.

Repository sealing

Once the radioactive waste has been stored in a geological formation, a decision should be made among finally sealing the repository, keeping it accessible, or retrieving the waste. Although we cannot foresee how future generations will decide at the turn to the next century, a basic combination of positions can be outlined. We simplify the case by taking only the option 'sealing,' and the positions 'in favor' or 'against'. We further consider three groups of actors: people living in the host community, the nation-wide population, and the Parliament. Of the three possible scenarios, 1. a consensus (or broad majority) in favor of sealing the repository, 2. a consensus (or broad majority) against sealing, or 3. no consensus, i. e., disagreement on the matter, we assume that 3. is likely. Thus, we assume that the details of repositories will be as contentious in the future as they are today.

Similar to Eckhardt (2021, p. 22), we assume in our analysis that predominant values in present day Germany will not be fundamentally different in the long-term. For sure, a weakening of the democratic system cannot be fully excluded, but if a functioning democracy still exists in Germany in the moment of the decision to sealing or not, it can be assumed that learning institutions could adapt or be transformed according to changing values, which could be still negotiated in democratic processes of public opinion and will formation and transformation. Thus, assuming that there will be democratic structures in situation 3, the question will be who gets the authority to decide and who should take costs and liability to govern an un-sealed repository. In its final report, the commission states that, from today's point of view, the decision cannot be in the hands of the operator and the licensing authority, but must again be taken by Par-

2 StandAG § 16, see also § 10 (4).

liament, as is the case in the present siting decision (KLA 2016, p. 270). The issue at stake speaks in favor of this assessment: In the case of repository sealing, considerations about safety and justice are both relevant. Assuming that the future world could be full of problems (the effects of climate change, a war near the repository site), it seems imperative to free future people from the risks and burdens of managing an accessible repository (Ott 2020, pp. 180–181). At the same time, making the repository inaccessible seems to violate their right to decide, i. e., would impose the decision of the then-living over future people and restrict their freedom of action (Ott 2020, p. 183; Riemann 2017, p. 164). The decision-making power should then be entrusted to an institution that is capable of legitimately balancing the various interests. Assuming democratic nation states in the future, we cannot envisage a better institution than freely elected parliaments. Local actors will not be able to decide on behalf of the entire citizenry, and a nationwide plebiscite in its present form is not compatible with the basic law.

Nation-wide, the public should be involved in the deliberative preparation of the decision-making process. For this purpose, they could profit from an ongoing discourse on HLW management if the knowledge base is maintained (for a present example see Röhlig 2022). In this way, the tasks and responsibilities, advantages and disadvantages of an open repository can be part of the public opinion formation. The mode of participation for the local citizens should be, however, more than just being involved. Local authorities at the host community should have formal access to the hearings concerning the sealing, giving the local citizens the possibility of shaping the decision-making process. Local interests/values must be considered not only in the search for a site but also in the case of sealing because they would probably change after the repository is built. In both cases, local interests and public interests should be balanced, and local authorities can be a "connecting link" between the national authorities and the local citizens (Mbah and Kuppler 2021, pp. 433–435).

The adequacy-relation between tasks and participation forms

Citizen participation will have to play a central role in further stages of the process after the site selection. In addition to 'voice' and 'vote,' a participatory interpretation of deliberative democracy stresses the importance of involving citizens in deliberative settings within the intermediate zone between political power and civil society. This holds true for the complex and highly contested process of HLW disposal in particular. Relying on the two cases above, we can now specify the idea of adequacy of participation forms according to the principles of justice and safety:

For a task or problem that implies only or primarily justice aspects, like compensation of negative impacts, the adequate form of participation is granting the affected parties real decision power. Different actors, including scientists and stakeholders, may jointly work on novel compensatory models, but affected parties should finally decide which compensatory options they prefer and how to spend the means.

For a task or problem that concerns both safety and justice aspects, in which safety and security are given priority, citizen participation without decision power is appropriate. This holds true for the case of sealing the repository. The extent of influence should be greater than mere 'involvement,' but not so strong as veto-power, especially if this is granted to particular groups, e.g., some minority groups in the future favoring a 'rolling stewardship' concept of long-term governance. Citizen participation in the form of 'jointly shaping' the decision-making process is, in this case, the adequate form.

Cases that concern primarily safety issues, e.g., container technologies, need to be analyzed in order to assess the appropriate participation mode. According to Krütli et al. (2010, pp. 870–871), decisions on safety issues would rely on experts and allow a lesser degree of public participation, although some 'active' forms of participation as 'public reviewing' could still prove fruitful. The peculiar societal dialectics between 'risk' and 'danger' (Luhmann 1991) give a strong risk-theoretical reason why persons who feel endangered should not decide if stakes are high, but should put pressure on experts that safety and security be optimized in given safety cases. To do that, the intermediate deliberative zone and thus the mode of 'being involved without decision power' would be the appropriate one. It is also probable that concepts of safety change over time. For integration of new concepts in long-term final disposal governance (Mbah and Kupler 2021, pp. 417–418), citizen involvement in the intermediate zone would be adequate.

Further elaboration should also allow to identify demands for participation which are inadequate. Making the adequacy-relation between participation modes and tasks more transparent is important for two reasons: first, a missing or unclearly defined adequacy-relation could be a source for many kinds of criticism, protest, and failure. Second, and more important, a clear adequacy-relation might be an alternative to mere demands for 'more participation'. Maximizing participation might come at the expense of legitimate state's power to act and to find a solution being acceptable to the entire citizenry.

Even with a transparent adequacy condition there still are other risks within participation that emerge if agents adopt a strategic attitude within deliberative settings. Participation can be strategically misused by groups which take a primary interest in de-legitimizing the state. There can be hidden agendas being pursued in participatory formats. There might be kinds of excessive participation with much political rhetoric, but without deliberative content. We regard it important to mention these risks of failure, but it would take another article to analyze them in detail from a discourse-ethical perspective. Making adequacy-relations between tasks and formats more transparent might still improve participation policies in general and, hopefully, even within the site selection process in particular and specifically after site selection in Germany.

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