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The discursive politics of nuclear waste: Rethinking participatory approaches and public perceptions over nuclear waste storage repositories in Switzerland

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ABSTRACT

Used nuclear fuel must be safely disposed. One solution to this complex challenge are deep geological repositories. Participatory approaches accompany the selection of suitable sites for these repositories in many countries and have been studied by risk perception scholars. However, most research has used quantitative cross-sectional data to explain the relationships among the variables of interest (particularly risks) and to inform nuclear policies. In this paper, we introduce a complementary perspective highlighting two fundamental factors: public opinions and their dynamics or stability. We provide results of a longitudinal survey (2 measurements 1 year apart) on plans for a nuclear waste repository in Switzerland. The respondents ($N = 841$) submitted their own arguments with which they would discuss the site selection process. In addition, we surveyed the respondents' general opinions. We found a focus on values and responsibility. Those in favor of the repository used different arguments than those who opposed it or were undecided on it. Women perceived the repository more negatively (general opinion) but did not use different arguments than men. A comparison over time showed that one third of the sample did not change their argumentation. The use of descriptive data to enhance policy-making processes is discussed.

1. Introduction

Reviewing the national and international efforts of governments and experts to find suitable solutions for maintaining sustainable energy production makes it clear that the process is neither simple nor straightforward. One type of energy, however, is especially controversial and poses policy makers with a difficult task: nuclear power. The question of whether to build, maintain, or phase out nuclear power plants is a hot topic among the governments and citizens of many nuclear-energy-producing countries. The resulting byproduct of nuclear waste (from not only the generation of nuclear power but also weapons production, industry, and research in medicine and pharmaceuticals) creates the challenge of finding the most suitable solution for storing this toxic waste for hundreds of thousands of years—a challenge which several nations have not yet found a solution to [1].

Many scholars working in this domain have conducted quantitative studies on factors related to nuclear issues, including attitudes, values, and perceptions of risks and benefits (see e.g., [2–8]). Such research has provided important insights, but real-life content and individual viewpoints have often been neglected due to the difficulties of collecting and

analyzing qualitative data. The aim of the present longitudinal survey was to provide insights to improve the participatory process in the site selection of nuclear waste repositories based on descriptive data gathered from open-ended questions.

2. Thematic background

2.1. Policy process for nuclear waste

Countries across the world face the problem of nuclear waste repositories [9]. Currently, most nuclear waste is stored near nuclear power plants, either in water-filled pools at reactor sites or in canisters at nearby interim storage facilities. From a technical point of view, researchers can agree based on scientific knowledge that deep-geological repositories (DGRs) are the most suitable solution for nuclear waste storage [10–14], but the process of building such repositories is rarely straightforward. In addition to geological restrictions and technical requirements, other factors are seen as necessary for a successful site selection process, particularly the involvement and participation of citizens and those affected [15], and the implementation of a stepwise

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procedure with defined rules and responsibilities [16].

Most democratic nations that manage high-level radioactive waste agree on a participatory siting process as a matter of policy, where governments make efforts to be transparent and accountable to citizens, and where issues such as public trust are seen as essential to supporting policy legitimacy [17,18]. The reason for this choice arises from the concept of governance, which suggests that successful governments involve stakeholders and the public to achieve societal goals [19]. The quality of policies should be enhanced in participative processes because collective intelligence is believed to facilitate problem solving and improve decision-making [20]. Studies on participatory governance in nuclear consultation processes [21] have suggested that governments should complement their consultation styles with more responsive and deliberative forms of participation. Some authors, emphasizing social learning [22] and empowerment [23], state that governments and stakeholders, in general, should give more strategic attention and respond to normative values.

This theory points to the high relevance of engaging in participatory processes and the need for adequate communication among actors. Pretre [18] suggested that rational argumentation among actors that leads to policy making can be achieved only after societal communication, in which sincere, competent officials listen to people, help them express their concerns, and then acknowledge these concerns. Such communication implies that the discourse should be oriented toward public interests. Therefore, a deeper understanding of what people's arguments on controversial topics involve, is crucial for successful policy and decision making. This point is relevant to the nuclear literature, where we often find the statement that it is highly difficult to reach a consensus through participatory processes (e.g., [24]).

2.2. Examples and the focus on Switzerland

Finland and Sweden are the most advanced European countries in the siting process for nuclear waste repositories. In 2015, Finland approved the world's first DGR for spent nuclear fuel on Olkiluoto, an island on the country's western coast [25], almost 30 years after beginning the process. In 2011, Sweden submitted an application for approval to build a DGR for spent nuclear fuel in Forsmark [26] after an almost 20-year siting process. In the United States, the first licensed DGR went into operation in New Mexico in the spring of 1999 [27]. This DGR, however, only stores transuranic waste from the US defense program and already experienced its first leak, in February 2014. The proposed DGR at Yucca Mountain in Nevada is the only site in the United States that may be considered for disposal of high-level waste under current law. However, in 2010 changes in US policy resulted in the suspension of the licensing process after the investment of many years and much money into research and development [28].

Switzerland has a long history of nuclear power and runs the world's oldest nuclear power plant, which began commercial operations in 1969. The amount of nuclear waste produced by its five reactors over their estimated lifespans and dismantling, along with medicine, industry, and research, through 2050 is predicted to be approximately 100,000 cubic meters, which will need to be stored safely for a considerable amount of time.

Consequently, Switzerland, along with other nations worldwide, needs to select a site for a DGR for low-, intermediate-, and high-level nuclear waste. In the Sectorial Plan for Deep Geological Repositories [29], the government outlines three necessary stages for selecting an appropriate repository site. In addition to geological and technical factors, socioeconomic factors are taken into account in the final decision. As of December 2014, the site selection process had reached the second of three stages, eliminating all but two of six potential DGR sites. The Federal Council will review the sites and is expected to make a final decision by 2017. The third stage will involve seismic surveys and depth explorations, and the results will be submitted to the Federal Council around 2020, along with an application for a general license for

a DGR. The final decision, expected by 2027, must be confirmed by the Parliament and could be subject to an optional referendum, giving Swiss voters active decision-making power in the repository siting [30]. The second and third stages involve not only the affected federal offices, cantons, and neighboring countries: Interested organizations and individuals have had and will have opportunities to express their views on the results, proposals, and decisions as part of a broad public consultation process. Thus, Swiss citizens are directly involved in the siting process, and their opinions and viewpoints are seen to be important and relevant.

2.3. Attitudes, values, and risks in nuclear issues

Clearly, controversial topics related to environmental and personal threats, such as nuclear waste, are not a recent phenomenon. Over the decades, many scholars have explained and clarified the factors that influence peoples' perceptions and understandings of these issues (e.g., [31]). To be participatory, the DGR siting process needs to focus not only on applying technical knowledge but also on understanding the risk perceptions, beliefs, and values of the different stakeholders and the public to develop nuclear policies that gain public acceptance [32,18,33].

All the facets of risk in many controversial topics, such as nuclear power and waste, have been the subject of study. Risk perception is defined as judgments and evaluations of any hazards to which people are or might be exposed [34]. This concept extends to the facilities or environments to which people relate and can be opposed to benefit perceptions. Based on these perceptions (risks and benefits), people decide whether to accept or reject issues, such as hazardous waste and nuclear facilities. This decision process (and the behavior resulting from risk and benefit perceptions) is complex and depends on the type of hazards concerned (e.g., [35–38]).

Gender differences might also arise in risk perception [39–42,6] as women generally perceive more risks than men. This implies that women's perception of more risks leads to more negative attitude toward controversial topics compared to men. However, other studies have shown that gender does not have any direct effects on attitudes toward nuclear topics [43].

Regarding nuclear waste and repositories, early studies on risk perception [44] showed that nuclear waste is perceived as a dreadful and unknown risk, and that attitudes toward this topic are very much related to affectivity ([45,75]). Studies on opinions on nuclear waste have found that people hold different opinions on nuclear waste repositories based on risk and benefit perceptions. Individuals who perceive more risks tend to oppose repositories, while those who perceive more potential benefits tend to support repositories [8]. In line with this findings, research has shown that positive attitudes toward nuclear waste repositories arise not only from a focus on benefits but more so from lower perceptions of risks [6].

However, the use of such factors (i.e., risks) has been criticized as too general in nature and problematic to thoroughly explain how these factors influence policy support. It is argued that general measures of risks (or values or general attitudes) do not give a clear view of the underlying meanings such factors might have [33,46]. What if a questionnaire does not include a specific risk? What if researchers are simply unaware of a specific value important to people and do not include it in their studies? These assumptions indicate that a general approach cannot exhaustively explain policy support. Researchers need to focus on different aspects and attempt to highlight useful results for policy makers. For instance, a complementary approach (e.g., qualitative, descriptive) could gather missing information directly from the public.

2.4. Approaches focusing on content and time

There is a wide range of projects focusing on nuclear waste, its risks,

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