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Like a bridge over troubled water – Opening pathways for integrating social sciences and humanities into nuclear research

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ABSTRACT

Research on nuclear technologies has been largely driven by a detachment of the 'technical content' from the 'social context'. However, social studies of science and technology - also for the nuclear domain – emphasize that 'the social' and 'the technical' dimensions of technology development are inter-related and co-produced. In an effort to create links between nuclear research and innovation and society in mutually beneficial ways, the Belgian Nuclear Research Centre started fifteen years ago a 'Programme of Integration of Social Aspects into nuclear research' (PISA). In line with broader science-policy agendas (responsible research and innovation and technology assessment), this paper argues that the importance of such programmes is threefold. First, their multi-disciplinary basis and participatory character contribute to a better understanding of the interactions between science, technology and society, in general, and the complexity of nuclear technology assessment in particular. Second, their functioning as (self -)critical policy supportive research with outreach to society is an essential prerequisite for policies aiming at generating societal trust in the context of controversial issues related to nuclear technologies and exposure to ionising radiation. Third, such programmes create an enriching dynamic in the organisation itself, stimulating collective learning and transdisciplinarity. The paper illustrates with concrete examples these claims and concludes by discussing some key challenges that researchers face while engaging in work of this kind.

1. Introduction

Research and policy-making in the field of nuclear technology and radiation protection has been typically grounded on a split between 'technical content' and 'social context', with a strong division of labour between natural and social scientists and a division of competences between 'experts' and 'the public'. However, following controversies related to nuclear accidents, the use of nuclear technology for military purposes, and the management of radioactive waste, the need for multi-disciplinary research and broader societal involvement in nuclear decision-making is increasingly recommended at national and supra-national levels for all aspects of the nuclear fuel cycle (Schröder and Bergmans, 2012; IAEA, 2002; Hedemann-Jensen, 2004). Examples include uranium mining (IAEA, 2009, p.3), the siting of new nuclear power plants (e.g. NRC, 2004), emergency situations (ICRP, 2009, p.12, p.23), rehabilitation of contaminated territories (OECD, 2006; Till, 2008), and radioactive waste management (Bergmans et al., 2008, p.25). This is reflected more and more also in European research programmes. A first attempt to integrate social sciences and humanities in European nuclear research has addressed issues of public participation and democratic decision-making in the siting of radioactive waste disposals (e.g. the E.C funded projects COWAM, ARGONA, CARL). Recent projects (e.g. OPERRA, PREPARE, EAGLE, CONCERT) seek to extend this integration to larger domains, such as radiation protection research, or specific areas, such as emergency management and rehabilitation of contaminated areas.

The call to integrate the links between research, innovation and society is not unique to the nuclear field; it is rooted in decades-old visions for collaboration between scientists, technologists and social scientists (Owen et al., 2012). It also aligns with recent proposals for more open and responsive modes of research and science policy-making, as illustrated by contemporary EU-wide policy discourses on "Science with and for society" and "responsible

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research and innovation". These policy discourses in turn build on interdisciplinary research fields such as science and technology studies (STS) and technology assessment.

The Belgian Nuclear Research Centre SCK•CEN initiated in 1999 its 'Programme for Integration of Social Aspects into nuclear research' (PISA). The aim was to unfold the societal, political, cultural and ethical aspects related to the development and use of nuclear technologies and guide policy in these areas. Put differently, PISA research aims at bridging nuclear science and society, by investigating how the two interact and how this interaction could be improved. The emergence of the programme inside a technical research institute was the result of an internal reflection acknowledging that insights from social sciences and humanities were required to better understand normative concepts that came to the fore at the time, such as precaution, sustainable development or safety culture (Eggermont, 2001). Given the status of SCK•CEN as a foundation of public utility, the establishment of the PISA programme was seen not only as an opportunity to explore alternatives to the so–called technocratic approach to science and technology development, but also as a responsibility towards society. From the onset of PISA, interaction has been sought with various stakeholders: researchers from nuclear and non-nuclear fields, policy-makers, representatives of the industry and members of the organised civil society or the lay public, with the aim of developing multidisciplinary and inclusive research activities.

This paper looks back at the fifteen years of PISA activity in order to illustrate and discuss this aim and ways to achieve it. It first situates PISA within the field of Science and Technology Studies (Section 2). It then discusses (Sections 3–6) the four current research strands: i) ethics of nuclear technology assessment; ii) radioactive waste management; iii) nuclear safety governance; and iv) perception and communication of nuclear risks. The first three strands focus on particular aspects of the life cycle of nuclear technologies, while the fourth is a transversal theme. Analytical insights derived within these research strands are highlighted, alongside practical implications, with special attention to their added value for nuclear and radiation protection research in general, and for the Belgian Nuclear Research Centre and the relevant stakeholders in particular. The final section highlights the challenges of reflective research programmes such as PISA, as well as their relevance for guiding practice and policy on complex and controversial issues such as the use of nuclear technology. It does so by identifying and discussing key challenges inherent to research located at the science-policy interface: independence, credibility, continuity and impact.

2. The PISA programme: an STS approach to nuclear technology

The establishment of PISA within SCK•CEN resonated with wider calls within the field of research and innovation studies. The need for multi-disciplinary and multi-stakeholder research frameworks – where the intertwined character of the social and the technical is the object of analytic engagement – is increasingly emphasized in social studies of domains pertaining to science and technology (Hackett et al., 2008), including that of nuclear technology (see e.g. Wynne, 1989, 1992; Jasanoff and Kim, 2009; Hecht, 2009; Pfotenhauer et al., 2012). The idea is that science and technology are "open to individual creativity, collective ingenuity, economic priorities, cultural values, institutional interests, stakeholder negotiation, and the exercise of power" (Stirling, 2008, p.263), and it is thus important to reflect on how this shapes the organisation of research and the formulation of policies.

Science and Technology Studies analyse science and technologies in their social contexts, as social phenomena in themselves. Whether it is only the 'context' that is social, while the 'content' remains to a certain degree independent, continues to be subject of discussion in this field (see e.g. Bijker and Law, 1992, p.201). It is, however, generally accepted in academic research and policy-making that there is at least an interaction between politics, values, culture, economics and regulations that influence science and technology, and vice versa (Jasanoff et al., 1995). Against this background, *technology* has at least three layers of meanings (Bijker, 1995): it encompass not only physical artefacts (such as a waste disposal facility, a radiological assessment tool or an incident reporting database), but also human activities (e.g. the process of analysing monitoring data or the reporting of incidents in a nuclear installation), and knowledge (e.g. models, lessons learned from past incidents).

Two notions are central, throughout STS in general and with respect to PISA work more specifically. The first is the notion of *co-production*, an interpretative framework for studying "the complex linkages among the cognitive, the material, the normative and the social" (Jasanoff, 2004, p.274). Co-production captures the understanding that science and technology are "neither a simple reflection of truth about nature, nor an epiphenomenon of social and political interests" (Jasanoff, 2004, p.3): both are mutually shaping. Along this line, STS scholars try to explicate the links and interactions between science, technology and society. This "capacity to understand how it is that people and technologies work together, shape one another, hold one another in place" is indispensable, because society cannot function without science and technology any more than science and technology can exist without appropriate social support (Jasanoff, 2004). For instance, (a part of) the Belgian society shaped the country's nuclear energy provisions, as much as the nuclear energy technology shaped Belgian society itself (Laes et al., 2007).

A second central notion in STS is that of *interpretive flexibility* (Pinch and Bijker, 1984; Bijker and Law, 1992); this implies that neither nature, nor society alone can speak clearly and unambiguously enough to prevent contestation. A clear illustration from within the nuclear field is the discussion about the health effects of low doses of radiation and the perception of these effects depending on the specific context of occurrence (e.g. Turcanu and Perko, 2014). Interpretive flexibility opens not only the possibility, but first of all the *necessity* for negotiation (Knorr Cetina, 1995, p.152). Controversies are thereby treated not as a threat, but as inevitable and potentially generative (Sismondo, 2008, p.14). One of the key interests in STS is to study what is at stake in controversies, how they get settled, and which "closure mechanisms" can be identified (Bijker, 1995, p.252). As such, STS also offers "a way of interpreting and accounting for complex phenomena so as to avoid strategic deletions and omissions" (Jasanoff, 2004, p.3).

The motivations for using STS as inspiration for PISA research are its capacity to provide a better insight in the epistemic and normative complexity of the nuclear issue (descriptive and explanatory purpose) and its potential to instruct normative policy guidance (prescriptive and moral purpose) (Jasanoff, 2004, p.17). These two aims are sometimes referred to as the High and the Low Church of STS. The former is more an 'academic' or 'fundamental' research endeavour of developing conceptual tools for exploring the development and stabilization of knowledge, artefacts and social orders. The latter is more of a 'policy oriented' or 'applied' research effort, concerned with making science and technology more accountable to public interests (Sismondo, 2008, p.18). For PISA, as located within a research centre of public utility, both aims are relevant, as illustrated by the research examples presented in the next sections.