2 Science in the context of sustainable development

Writing about science, sustainability and development issues and their political framing is not a straightforward task: The idea of science serving an external purpose alludes to larger philosophical questions about the relation and nature of science and society. In addition, working with terms such as *science, technology, innovation, sustainability* or *development* also calls for some reflections of these concepts before one can start considering the possible interrelations between them.

Within the following sections, I will shed light on some details of the larger theoretical context of science and potential societal goals, such as sustainable development, and on the role of science policy in this context. Exhibiting the range of possible discursive perspectives on science, society and policy and their interrelation helps to get a clearer picture of dominant perspectives of science and potential effects on sustainable development. This helps to put current policy and practice into perspective and will serve as a contrasting device for the later empirical chapters of this book.

2.1 Science for a cause? Between impact and autonomy

From a positivist point of view, science can be defined as

> "1. the systematic observation of natural events and conditions in order to discover facts about them and to formulate laws and principles based on these facts. 2. the organized body of knowledge that is derived from such observations and that can be verified or tested by further investigation. 3. any specific branch of this general body of knowledge, such as biology, physics, geology, or astronomy. (For the Latin word meaning 'knowledge')." (Gillespie 1992: 1926)

In contrast to this seemingly plain definition of science as a globally valid system of knowledge, ambiguities of the term become evident quickly from a constructivist perspective. Kuhn's seminal work on scientific *paradigms* (1962) as well as Foucault's work on *epistemes* (Foucault 2005 [1966]; 1972a) show how scientific knowledge is enabled, limited, directed, interrupted and re-interpreted through specific underlying meaning schemes. Other authors focus on concurrent diverging definitions

of science. Knorr-Cetina shows that different types of knowledge production – and subsequently different institutions of knowledge production – disintegrate science into scattered disciplines with their own standards, definitions, modes and world views (Knorr-Cetina 1999). While in its current role and function science still is "the premier knowledge institution of the world" (Knorr-Cetina 1999: 1), social scientists challenge that scientific knowledge is essentially different from any other types of knowledge (Sismondo 2008). On these grounds, science as a concept resists unequivocal definitions – like the concepts of *development* or *sustainability*.

When it comes to its role and function in relation to society, the conceptualisation of science reveals even further facets. Different perspectives on science diverge regarding their conceptualisation of its aims – ranging from purely fulfilling scientific interest to envisaged objectives outside of science itself. For a long time, science was considered as an entity independent of society. Based on a *l'art pour l'art* conception of science, Merton's norms of a disinterested, independent and pure science (Merton 1968) were the most commonly accepted code of conduct for research during the second half of the 20th century (Jasanoff 2003). In a similar vein, Polanyi argued that autonomy of science was necessary to ensure its creativity and productivity (Polanyi 2000).

However, the assumed autonomy of science from society underlying these models of science have been increasingly up for debate and have been gradually re-evaluated; the interdependence of science with other spheres of society has been emphasized (Jasanoff 2003). *Applied* sciences, those to find solutions (often in form of economically exploitable innovation) to a specific *real-world* issue and thus not purely aimed at fulfilling scientific curiosity, have become part of the accepted canon of scientific knowledge production. In addition, boundaries between applied and basic science were found to become increasingly blurry and distinctions useless (Barnes 1982; Rosenberg 1991; Jasanoff 2003). In consequence, scholars began to stress the heterogeneity of scientific modes of knowledge production in their conceptions of science and society, replacing the strict dichotomy of applied and pure science through the idea of a continuum of forms of knowledge production (among others Funtowicz and Ravetz 1993; Gibbons et al. 1994; Nowotny et al. 2001).

Today, competing discourses about the relation and interaction between science and other segments of society co-exist within the scientific community – but also in science policy. The conceptualisations range from the extreme poles of *autonomous* science, to the contrary idea of *relevant* science (Kaldewey 2013). Debates about the nature of science even enter the public arena (see Stock and Schneidewind 2014).

In view of any objectives beyond science, its *usefulness*, *applicability* or *relevance* can be defined in different ways by different actors in and for different, possibly competing, social spheres: It is highly context-dependent which type of science is

considered as socially relevant (Weingart 2008). Application-oriented technological science, for example, is often directed at economic relevance or applicability, while this *commodification* of science also is strongly contested by other parts of the science community (Radder 2010).

Next to economic usability, science may pursue other societal targets. Sustainability sciences, beyond investigating sustainable development as a *research subject* often also pursue sustainability as a *normative target*. The value of science is not purely seen in science as such, but science is viewed as a means to an end, in need of a normative direction (Ziegler 1998; Smith et al. 2010; Jahn 2013). *Development* is yet another potential societal objective of science and science policy. In order to have developmental impacts, science is often conceptualized as an impact-oriented or problem-solving type of science (Rhodes and Sulston 2009). Similarly, adherers of an engaged programme of science and technology studies seek to enhance a *socially responsible* science (Sismondo 2008) or to raise the *accountability* of science towards society (Jasanoff 2003).

Different interpretations of the links between science and society and diverse conceptualisations of scientific production and their corresponding effects on society thus coexist within the scientific community as well as in science policy (Glerup and Horst 2014). In drawing attention to these different conceptions, I'd like to emphasize the socially constructed nature of science. At the same time, the coexistence and potential plurality of conceptions of the relation between science and society raises the question why certain views persist at certain points of time in specific scientific communities as well as in science policy.

2.2 Science policy and society

Scholars point to the essential role that policies play in setting a future course and for framing societal problems, solutions and standpoints. As Clay and Schaffer noted in 1984 already, "policies can make a difference. Different policies could be chosen. There is room for manoeuvre" (1984: 1). Next to the relations between science and society as such, their governance on different levels is therefore receiving increasing attention. Due to the internationalisation of research and world-wide spread of the technologies produced, international policies with their influence on scientific networks and cooperation become important next to policies focussed at the local or national level (Smith 2009; European Commission 2009; The Royal Society 2011). The policies themselves turn into a topic of interest, as they are perceived as a lever setting the conditions for potential impact on society, including development (Bucar 2010; STEPS Centre 2010).

Science policy, in a broad sense, refers to those policies directed at fostering, organizing and steering research activities. Sarewitz et al. for example define it