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Tailoring CTA for emerging technologies

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Abstract

Technology assessment (TA) has developed into a method that puts a strong emphasis on facilitating interfaces between supply of science and technology and the demand for useful applications. Recently, we also see that TA becomes an integral part of science and technology programs, for instance in nanotechnology. The basic aim of the latter is to articulate the needs, wishes, and constraints, for example from professional users, already in the emerging stage of technological development. TA methods come in many different forms, although they are often different versions of a limited set of 'basic approaches' adapted to specific conditions with the overall aim to improve societal embedding. The thrust of this paper lies in the development and results of a variant of constructive TA (CTA), addressing technological development in an early phase in order to bypass the Collingridge dilemma by developing and testing scenarios including options for the further development of emerging technologies.

How to support a broad selection of relevant actors effectively with CTA in such a way that they are enabled to play their role in innovation processes of emerging technologies? This is the main research question taken up in this paper. To take on this challenge we develop, apply, and evaluate an intervention we named the 3-step constructive technology assessment (CTA) approach. We will apply the approach to a nanotechnology related topic, Lab-on-a-chip technology. By assessing the effects and evaluating the proposed approach, we also want to contribute to the development of new methodological insights relevant for the TA community.

Keywords: Constructive technology assessment (CTA); Methodology development; Emerging technology

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1. Introduction

Emerging technologies appear to be unorganized and chaotic where merely expectations and visions guide the field, rather than hard facts and prime examples 'out there'. They are therefore different from later stage technologies owing to the absence of transparent and structured relations between actors and the high level of uncertainty on future paths to take. In contrast, more mature technological developments are developing in systems with relatively well-defined actors, relations, and institutions.[1] They are also bound to the formation of paths, meaning that in later stages of development some specific trajectories will be chosen over others. Both aspects lead to a reduction of uncertainty.

Technology assessment (TA) strives to improve the societal embedding of technologies, which means the extent of integration with relevant industries and markets, the admissibility with regard to regulation and standards, and the acceptance by the public [2]. This is a (collective) search process that should be guided in such a way that more desirable paths might be achieved (cf. [3], p. 8): "That entrenchment occurs, and certain paths will be followed, is inevitable. The point is that some paths are better than others, meaning that they result in improved societal embedding. These paths should be actively *sought and shaped*" (italics added). In this paper we develop, apply, and evaluate an intervention that facilitates this *search process* for a broad selection of relevant actors. However, for emerging technologies this search process is subject to the so-called Collingridge dilemma [4]: in early stages opportunities to steer are plentiful, but hard to choose from, while at later stages this is reversed. Special arrangements have thus to be made to deal with this dilemma. Only by changing the actions and interaction of the actors involved in the innovation process the *actual shaping* can be altered. The actors have to be better prepared to do this job. This preparation should consist of broadening the perspectives of actors and providing them with insights in the sociotechnical dynamics (the way technologies are managed and actually develop in society) of a specific emerging technology. The result is that actors gain a wider view on the innovation process, a broader view on possible applications and their consequences, and a better understanding how innovations develop in the first place. These capabilities then enable the actors to do better in their normal environment in contributing to more desirable paths.

The need to enroll (representatives of) a broad selection of relevant actors in the intervention comes from the fact that many different actors may play an important role in the development of technologies [5]. All different expertise, from scientific throughout use and regulation, are highly valuable. Theories like Social Construction of Technology [6] and Actor Network Theory [7] conceive the development of technologies and their embedding in society as a co-evolutionary process. Von Hippel points at the importance of users as sources of innovation [8]. Science and technology studies literature stresses the importance of the broad acceptance of technologies by different societal groups. In playing a role in the innovation process, actors encounter many barriers. These barriers partly result from a lack of information on the potential problems in the discussions and negotiations with other actors. The main research question is the following:

> How to support a broad selection of relevant actors effectively with CTA in such a way that they are enabled to play their role in innovation processes of emerging technologies?

[1] These systems are often referred to as innovation systems or technology-specific innovation systems [1]. In the case of emerging technologies, these systems still have to develop.