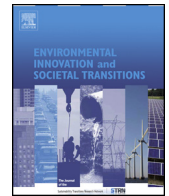




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Challenges for Technological Innovation Systems research Introduction to a debate



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The framework of Technological Innovation Systems (TIS) has developed into one of the salient conceptual building blocks of sustainability transitions research over the past two decades. Its emphasis is on success conditions for socio-technical innovations and emerging industries. It adopts a systemic perspective by analyzing the role of a diversity of actors, their interaction in networks and the role of institutional arrangements in the promotion or hindering of innovations. As such, TIS is part of a larger family of innovation systems frameworks, like national, regional or sectoral innovation systems. In contrast to these related approaches, TIS studies have always focused on specific technological fields and were, as a consequence probably, among the first to address sustainability-related innovation and industry formation processes.

Over the years, TIS scholars have generated an impressive portfolio of analyses related to environmental innovations and the emergence of cleantech industries. Empirical work mostly focused on developments in OECD countries and on sectors such as energy, mobility, urban water management and food (Markard et al., 2012). Conceptually, the TIS approach moved from its earlier structural and rather static analyses of configurations of actors, networks and institutions to more process oriented and dynamic accounts, as exemplified by the functions approach to TIS (Bergek et al., 2008). Last but not least, TIS scholars aim at informing innovation policy, which led to a long list of fruitful interactions between TIS scholars and policy makers.

Despite a growing number of empirical studies, conceptual refinements and an increasing impact on innovation and industry policy, there has been recurrent criticism of the TIS approach in the transitions literature. The most fundamental critique states that TIS approaches tend to be overly technology focused and therefore unable to appreciate the role of incumbent industry interests and strongly institutionalized structures. As a consequence, TIS scholars are blamed to reduce transitions to a simple problem of diffusing new and better technologies, whereas the reorientation of user practices, power relationships, regulatory structures, mind sets and public discourses remains unaddressed. Furthermore, due to its primary focus on initiatives in OECD countries, the tradition was criticized to only cover a very narrow set of potentially relevant developments. TIS studies would therefore at best be able to identify the more trivial instances of the bigger challenge of sustainability transitions. Some of these critiques even went as far as claiming that innovation systems approaches had seen their best days, and should give way to newer and better suited innovation and transition concepts. TIS proponents typically reject these lines of criticisms as providing an overly simplistic portrayal of the state of the literature. They claim that technologies have always been conceptualized as socio-technical systems and that the analysis of emerging industries is mostly referring to the interplay between actor strategies and institutional dynamics. As a consequence, it is able to address much more complex transition processes than mere linear diffusion trajectories (see also, Bergek et al., 2015).

This state of affairs provided the motivation for organizing a panel discussion about the future of the TIS approach at the fifth international sustainability transitions conference in Utrecht in 2014. A number of established transition scholars

were invited to elaborate on major challenges that TIS research is currently facing but also on the most recent conceptual developments. The ensuing debate at the conference was very lively and provided important new insights. This led the organizers to propose the present debate format to the EIST editors in order to present the results of the panel to a broader audience.

The current special section is organized as a collection of four viewpoints, which reflect main lines of arguments that were raised on the panel. Three viewpoints formulate critiques of past TIS research: The first contribution by [Florian Kern](#) mainly criticizes the sometimes politically naïve conception of innovation processes in TIS studies and questions the suitability of the TIS framework to analyze fully-fledged transition processes. The second viewpoint by [Lars Coenen](#) elaborates the need for a geographically more sensitive approach to the analysis of industry dynamics. Thirdly, Bening, Blum and Schmidt discuss how relevance for policy makers could be improved in future TIS studies. The final contribution by [Markard, Hekkert and Jacobsson](#) formulates a rebuttal to these critiques but also identifies recent promising developments in the TIS literature.

The present special section, simulating a debate by a sequence of short viewpoints, can be seen as a new item of this journal. We are open to suggestions for similar debates on other topics in the realm of environmental innovation and sustainability transitions.

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