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Global socio-technical regimes

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ABSTRACT

This paper addresses the question why socio-technical transitions follow similar trajectories in various parts of the world, even though the relevant material preconditions and institutional contexts vary greatly between different regions and countries. It takes a critical stance on the implicit methodological nationalism in transition studies' socio-technical regime concept and proposes an alternative 'global' regime perspective that embraces the increasingly multi-scalar actor networks and institutional rationalities, which influence transition dynamics beyond national or regional borders. By drawing on globalization theories from sociology and human geography, we show that socio-technical systems often develop institutional rationalities that are diffused via international networks and thus become influential in various places around the world. In so doing, we shed light on the multi-scalar interrelatedness of institutional structures and actors in socio-technical systems and elaborate on the implications for the conceptualization of transition dynamics. The paper illustrates this with the case study of an unsuccessful transition in the Chinese wastewater sector. Recent studies indicate that key decisions on wastewater infrastructure expansion were not only influenced by path-dependencies stemming from China's national context, but equally (or even more critically) by the dominant rationality of the water sector's global socio-technical regime. We conclude by discussing the contours of a new research agenda around the notion of global socio-technical regimes.

1. Introduction

Studies in the field of sustainability transitions aim to explain how socio-technical change unfolds and how a transition towards more sustainable production and consumption processes can be achieved (Markard et al., 2012; van den Bergh et al., 2011). An important assumption is that socio-technical systems are rigid and inert, making change and innovation incremental and path-dependent (Geels, 2002; Markard and Truffer, 2008). Stability in socio-technical systems is attributed to the presence of highly institutionalized formal and informal rules that have co-evolved with certain technologies and solidified into practices and routines. The concept of the *socio-technical regime* has been developed to capture and analyze the substance and effect of these rules of the game on transition dynamics (Karlton and Sandén, 2012; Kemp et al., 1998; Markard and Truffer, 2008; Smith et al., 2010). The regime denotes the 'deep-structure' or 'grammar' of a socio-technical system, defining appropriate, legitimate and conceivable means-end rationalities in a given sector (Geels, 2010). Transitions are defined as a shift from one socio-technical regime to another, which, according to the multi-level perspective (MLP), happen through a combination of (macro) landscape pressures and (micro) niche developments (Geels

and Schot, 2007).

In recent years, theory development in transition studies has shown to incorporate two major trends. First, scholars called for a better conceptualization of regimes, thereby mainly advocating a more sophisticated analysis of institutional structures and processes of institutional change in socio-technical systems (Fuenfschilling and Truffer, 2014; Geels, 2004; Smink et al., 2015; Wirth et al., 2013). It is argued that a regime represents the dominant institutional rationality of a system and that transitions can therefore be described as processes of (de-)institutionalization, i.e. institutional change. To better address the question of how institutional change unfolds, institutional theories from sociology, organizational studies and political science have been used to enrich transition studies. Advancements have been made regarding our understanding of the structuration of regimes (Fuenfschilling and Truffer, 2014; Geels, 2004), the role of actors in changing or maintaining regime rationalities (Fuenfschilling and Truffer, 2016; Jolly et al., 2016; Smink et al., 2015) or the gradual transformation of regimes (Dolata, 2011).

Second, many recent contributions emphasize the need for a more nuanced analysis of the spatial dimensions of transition dynamics (Binz and Truffer, 2017; Coenen et al., 2012; Murphy, 2015; Raven et al.,

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2012). It is argued that transitions unfold unevenly across space and that certain countries and regions are more apt to transforming their economy than others. Research in the emerging field of ‘geography of transitions’ has focused on understanding why transitions succeed in some places while they fail in others (Hansen and Coenen, 2015; Raven et al., 2012; Truffer et al., 2015). Using insights from economic and human geography, scholars have in particular pointed to the importance of specific places, such as cities or regions, as the primary locus of socio-technical change and innovation (Hodson and Marvin, 2010; Murphy, 2015; Späth and Rohrer, 2010). Moreover, they have debunked the idea that niches are local, geographically confined spaces by showing that niches often consist of multi-scalar actor networks and discourses that get implemented in many places at once (Binz et al., 2016b; Fontes et al., 2016; Raven et al., 2012; Sengers and Raven, 2015; Wieczorek et al., 2015).

While institutionalists tend to ask the question why things are so similar (pointing to the structuration of regimes), geographers rather ask why things are so different (pointing to the diversity of niche developments in different places), which, according to us, is one of the main reasons why the two research streams do not show much overlap at this point. As a consequence, there is a substantial lack of understanding regarding the spatial specificities of socio-technical regimes. In this paper, we want to make a first step towards fruitfully combining the two perspectives. We argue that in order to understand transition dynamics it is crucial to not only study the multi-scalar characteristics of particular niches (as geographers have done), but also the spatial particularities of regimes, i.e. of dominant institutional rationalities (which are the domain of institutional scholars).

In order to develop a more spatially sensitive regime concept, we will draw on theoretical approaches from sociology and human geography that have explicitly dealt with questions of space in the construction and diffusion of institutional and social structures. Empirical evidence suggests that institutional structures, such as cultural-cognitive rationalities, norms and regulations, as well as the actor networks that are crucial in constructing and diffusing them, are today increasingly internationalized. Contributions in the realm of neo-institutional theory have traced the existence of a universally valid institutional rationality since World War II that shapes the development of many industries worldwide (Boli and Thomas, 1997; Meyer, 1996; Meyer et al., 1997; Meyer et al., 2009). This literature explains why and how a global culture develops, what it is made of, how it diffuses across national boundaries and to what extent it shapes local contexts (and vice versa). On the other hand, literature on global production networks (GPN) and global value chains (GVC) has argued that in today’s globalizing knowledge economy, many sectors evolve in internationalized actor networks which regulate production and innovation processes in a geographically fragmented manner, beyond the confines of regionally or nationally defined territorial boundaries (Gereffi et al., 2005; Henderson et al., 2002; Yeung and Coe, 2015).

It is therefore increasingly plausible to assume that socio-technical regimes achieve validity beyond the immediate national contexts. This paper therefore proposes an internationalized conceptualization of socio-technical regimes and elaborates on the implications thereof for the study of sustainability transitions.

The paper continues as follows. Chapter two will give an overview of the state of the art literature on socio-technical regimes and then introduce the main arguments from globalization theories in sociology and human geography. Chapter three will subsequently outline their implications for a conceptualization of global socio-technical regimes. In chapter four we demonstrate the explanatory value of such an approach with the illustrative case study of how China failed to transition to a potentially more sustainable configuration in its waste water sector due to various pressures stemming from a global water regime. The paper concludes by outlining an agenda for the study of sustainability transitions, in particular regarding the conceptualization of change, agency and power, as well as space.

2. State of the art on regimes, institutions and globalization

2.1. The evolution of the regime concept

One of the most fundamental claims in transition studies is that socio-technical systems are rigid and inert. Innovation is usually following an incremental trajectory, which makes radical change unlikely. This path-dependency is ascribed to the existence of socio-technical regimes. A well-known basic definition characterized regimes as “the rule-set or grammar embedded in a complex of engineering practices, production process technologies, product characteristics, skills and procedures, ways of handling relevant artefacts and persons, ways of defining problems; all of them embedded in institutions and infrastructures” (Rip and Kemp, 1998: 340). Regimes were later conceptualized as semi-coherent rule sets carried by different social groups, which stabilize a technological trajectory and function as a selection and retention mechanism (Geels, 2002: 1260; Smith et al., 2005).

The evolution of the regime concept in innovation and transition studies can be described as moving from a conceptualization based on insights of evolutionary economics towards one drawing more on institutional theory (Fuenfschilling and Truffer, 2014; Geels, 2004; Rip and Kemp, 1998; Smith et al., 2005; Van der Vleuten and Högselius, 2012). At the beginning, concepts such as technological paradigms and trajectories, organizational routines or path-dependency took center stage to explain why technological innovation develops incrementally along a specific path (Dosi, 1982; Kemp, 1994; Nelson and Winter, 1982; Rip and Kemp, 1998). Persistence was seen to stem from cognitive models, mostly referring to engineering knowledge and corresponding routinized practices. These notions have later been complemented with a more fine-grained analysis of social structures as regulative, normative and cognitive institutions (Geels, 2004; Van der Vleuten and Högselius, 2012).

While some scholars have defined regimes as to entail material structures (Hoogma et al., 2002; Rip and Kemp, 1998), others have conceptualized them entirely in institutional terms, stressing first and foremost the “rules of the game”-properties of regimes (Fuenfschilling and Truffer, 2014; Geels, 2004). This paper also follows such a rule-based definition. This does however not imply that materiality is not relevant. On the contrary, materiality, particularly in the form of technologies, is seen to co-evolve with social structures and shape them. The dominant rules of the game that evolve out of such an interaction are, however, institutional and especially cultural-cognitive in nature. The socio-technical regime therefore does not denote concrete social and material practices, but rather the principles that pattern those practices, i.e. the dominant rationality in a system that specifies ideas about cause and effect, defines legitimate means-end-relationships, influences what is conceivable and orders interactions of all sorts (Sewell, 1992). A socio-technical regime can thus be conceptualized as the dominant institutional logic of a socio-technical system (Fuenfschilling and Truffer, 2014; Thornton et al., 2012).

In this conceptualization, regime rationalities are by no means stable and monolithic, but subject to contestation and power battles by interested actors and therefore continuously socially constructed (Fuenfschilling and Truffer, 2016; Geels, 2014; Kern, 2009; Smink et al., 2015). The socio-technical regime can be interpreted as the result of an interplay between actors, technologies and institutions in a system. Rationalities are institutionalized and anchored in various places by codifying them into routines, standards, practices, technologies and so forth. The degree of institutionalization of a regime, and with that its impact on actors, is thus heavily dependent on its translation into practice (Fuenfschilling and Truffer, 2016; Hajer, 1995; Murphy, 2015; Strang and Meyer, 1993).

In terms of explaining innovation and transition dynamics, it has proven fruitful to draw the boundaries of socio-technical regimes at the sectoral level, focusing on socio-technical configurations that ‘fulfill a specific function’, such as water supply and sanitation, energy provision

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