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System interactions in socio-technical transitions: Extending the multi-level perspective

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ABSTRACT

This paper discusses contextual issues in sociotechnical systems and transitions under the Multi Level Perspective (MLP). It emphasises inter system interactions, for which a typology is developed drawing on a review and meta level analysis of published transition case studies. The typology is subsequently associated to the MLP transitions pathways. A novel transition pathway, is derived through this process, namely new system emergence, for systems that emerge from contributions of existing antecedent sociotechnical systems.

1. Introduction

Sociotechnical systems frameworks are developed to conceptualise and understand large scale complex processes of technology, production, and social change. Transition studies provide a rich account and understanding of such system changes. Lately a particular emphasis has been placed on transitions towards sustainability. In systematizing the knowledge regarding sociotechnical transitions, a number of transition typologies based on different criteria have been proposed. They include: (i) the transition pathways typology (Geels and Schot, 2007) following the Multi Level Perspective (MLP), (ii) the multi regime interaction approach (Raven and Verbong, 2007), (iii) the transition contexts approach (Smith et al., 2005), (iv) the framework of de Haan and Rotmans (2011), and (v) the framework of Rotmans and Loorbach (2010).

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This paper concentrates on the MLP transition typology which draws mainly on explanations of historical transitions (Smith et al., 2010) and utilises two criteria: the nature and timing of intra system element interactions. These can take place between regimes and niches that are internal to a sociotechnical system. A sociotechnical system can be thought of as a set of heterogeneous interlinked elements that fulfil a societal need through technology. The dynamic, stable state of these elements constitutes a regime, whereas novel configurations and states deviating from it constitute niches which form around markets or technologies. In the majority of published studies to date, the MLP considers system transitions as stand alone processes i.e. as a result of interactions taking place internally in a single focal sociotechnical system, with additional system elements situated in external landscape, regimes, or niches. However, given the complexity of our world, this perspective is rather limited. It is very rare to find societal and sociotechnical system transitions which are not influenced at any stage of the transition by processes taking place in other interrelated systems (Shove, 2004; Loorbach, 2007; Smith et al., 2010). This has resulted in some critique of the MLP regarding its application, the view that transition processes originate primarily in niches and that they are single system processes (Geels, 2011; Smith et al., 2005; Genus and Coles, 2008).

While there have been some attempts towards the study of multi system element interactions, they were mostly focused at interactions between regimes of the same or similar sociotechnical or societal systems. For example, Smith et al. (2005) argued towards more inclusive, not just niche based, explanations of sociotechnical transitions. They stressed the role of internal/external agency and resources to the regime and viewed transitions as a function of the selection pressures that the regime faces, and the coordination of the available internal or external resources for responding to these pressures. In the same line Raven and Verbong (2007) proposed a framework that conceptualised four types of interactions across regime boundaries: (i) competition between regimes, (ii) symbiosis of regimes with a mutually beneficial interaction, (iii) integration of regimes into a single entity and (iv) spill over where rules are transferred from one regime to another.

This paper focuses on the interactions taking place among sociotechnical systems during transitions. It aims to explore, describe and classify sociotechnical system interactions by reviewing and analysing a number of cases reported in the literature of sociotechnical system transitions. The intention is to bridge the gap between the analysis of single system transitions with the MLP, for which it has been critiqued (Smith et al., 2005; Genus and Coles, 2008), and the need for analysis of multi system cases, an issue that is particularly relevant to sustainability transitions (Geels, 2011; Konrad et al., 2008). From a systems perspective, the study of multi system interactions poses two challenges: (i) to define the boundaries of the systems under study (usually there is more than a unitary system – regime relation, as components of other external systems are involved in the formation or transformation of regimes), (ii) to identify the mechanisms, processes and actors, which influence the evolution of a sociotechnical system and may or may not be part of it. A fundamental issue in this regard is distinguishing between regimes and niches that are internal or external to the focal system of analysis. This distinction is necessary in order to make the analytical step from intra to multi system interactions and transitions.

In order to meet these challenges the paper derives by induction a typology of transition system interactions from thirteen published transition cases on which the development of MLP transition pathways was based (Geels and Schot, 2007). Two additional multi system cases are included in the paper. In developing the typology of interactions the aim is to include all possible sociotechnical system interactions and to associate them with transition pathways. The underlying hypothesis is that these interactions are an important characteristic of sociotechnical system transitions. Therefore instead of focusing on a single case that would provide an in-depth description of a phenomenon (Siggelkow, 2007), multiple case studies are analysed to provide a wider scope for theory development (Yin, 1994).

In this way the concept of system interactions is well grounded to published MLP cases in the literature and an increased emphasis is placed on multi system interactions. In a manner analogous to laboratory experiments, the proposed concept of system interaction is systematically and iteratively applied to each case, in order to assess how well or poorly it fits with it (Eisenhardt, 1989). The result of the comparison enables an informed judgement on whether the concept of system interactions is idiosyncratic to a specific case study or is consistently found in several cases (Eisenhardt, 1991). This process enables the selection and retention of system interaction types with the greatest possible