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Analysis of institutional work on innovation trajectories in water infrastructure systems of Melbourne, Australia

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ABSTRACT

Infrastructure systems are facing sustainability challenges but are locked into their current practices. Transitions studies aims to understand trajectories towards new socio-technical regimes and argue for agency-centric perspectives to explain processes of change. This paper adopts an institutional lens, examining the institutional creation processes needed for maturing innovations within established systems. Three innovations in Melbourne's water system were selected as empirical cases: desalination, wastewater recycling and stormwater harvesting. Each had a different institutional alignment with the established regime and different trajectories between key stages of maturity, from pre-niche to niche, niche-regime and regime. The paper examines the purposes and types of institutional work undertaken to support each stage: cultural-cognitive, normative and regulative. Their trajectories were influenced by the regime alignment and characterised by maturation speed, institutional work undertaken and limiting conditions for further maturation. Cross-case comparison enabled derivation of hypotheses on the linkage between institutional work and innovation maturity.

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1. Introduction

Complex infrastructure systems such as water, energy and transportation are facing immense sustainability challenges globally. Impacts of climate change, population growth, ecosystem degradation and resource limitations are having significant consequences for how well these systems can deliver services that adequately meet societies' needs (e.g. Bates et al., 2008; Frantzeskaki and Loorbach, 2010; Westley et al., 2011). Despite a growing scholarly and practical awareness that fundamental changes in urban infrastructure systems are required (e.g. Chapin III et al., 2010; de Graaf and van der Brugge, 2010; Pahl-Wostl, 2009; Truffer et al., 2010), sectors are locked into their current approaches due to barriers such as path-dependencies, institutional inertia and inadequate actor capacity to engage in new practices (Berkhout, 2002; Farrelly and Brown, 2011; Frantzeskaki and Loorbach, 2010; Pahl-Wostl, 2009; Westley et al., 2011). To overcome these challenges, scholars argue it is critical to support the emergence, up-scaling and stabilisation of innovative technologies and practices that increase the sustainability of urban infrastructure systems (Frantzeskaki and Loorbach, 2010; Pahl-Wostl, 2009; Truffer et al., 2010).

Transitions studies focuses on addressing path-dependencies, with particular attention on trajectories towards new socio-technical regimes that are likely to encompass a range of innovations. In recent years, this scholarship has advocated that further explanatory detail on the role of agency in stimulating and steering the maturation of innovations is needed (e.g. Brown et al., 2013; Farla et al., 2012; Grin et al., 2011; Markard et al., 2012). An institutional lens that focuses on the institutional structuring processes that actors put in place may contribute to developing this more agency-centric perspective for understanding processes of transitional change (e.g. Brown et al., 2013; Geels, 2004; Geels and Schot, 2007; Truffer et al., 2009).

In this study, we define an innovation as a new technology and associated practices within an existing infrastructure system, which provides an alternative utility (e.g. harvested stormwater runoff or recycled wastewater as new city water supplies). Following Geels and Schot (2007), it is possible that innovations could reinforce and/or disturb the established regime of the infrastructure system, depending on whether their nature is as a replacement, or as a competence-enhancing add-on. Realisation of the innovation's utility is likely to depend on the role of agency and associated institutional structuring processes mediating the dynamics between the innovation and the regime.

From an institutional perspective, the maturing of an innovation is reflected by the development of a new set of institutions that could co-exist or undermine those of the established regime. Drawing on Scott's (2008) new institutionalism research, an innovation that is fully institutionalised would be characterised by a mature suite of mutually supportive cultural-cognitive, normative and regulative structures, which collectively provide the 'rules' for reinforcing its realisation within the infrastructure system. The efforts to develop this suite of structures has been described as 'institutional work', which brings focus to the role of deliberate agency in creating, maintaining and disrupting formal and informal institutions (Lawrence and Suddaby, 2006; Lawrence et al., 2011). The evolution of institutional work in relation to the maturity of an innovation is yet to be explored.

The aim of this paper is therefore to develop the first set of hypotheses on the type and purpose of institutional work needed to establish innovations within an existing infrastructure system. To do this, the paper focuses on how institutional work to create new institutions evolves between key stages (i.e. from pre-niche, to niche, to niche-regime, to regime) during the maturation of innovations. Three innovations were selected as empirical case studies with different institutional alignments (reinforcing and/or disrupting) with the established regime to ensure an internally valid and reliable base for hypotheses development.

The study context is the water system of metropolitan Melbourne, involving a system-scale empirical analysis of the dominant patterns of institutional work that reflected the maturing of desalination (reinforcing), wastewater recycling (reinforcing and disrupting) and stormwater harvesting (disrupting) between 1997 and 2012. These innovations emerged as novel and qualitatively different to the status quo, attracting variable levels of public confidence and controversy as alternative water supply approaches. The three case studies, treated as innovations, were therefore considered ideal for this research.