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Actors working the institutions in sustainability transitions: The case of Melbourne's stormwater management

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ABSTRACT

The role of agency in overcoming path dependence and enabling sustainability transitions is receiving increasing attention. Currently lacking are more empirically derived explanations of the co-evolutionary dynamics between actors and institutional change that could potentially provide guidance on facilitating such transitions into the future. This paper investigates these dynamics through a longitudinal case analysis of Melbourne's transition to improved stormwater quality treatment. The complex data collection, analysis and validation approach, which included oral histories, semi-structured interviews, industry workshops and documentary analysis, examined the nuances of the actor-related strategies and institutional enabling processes throughout the different phases of the transition over the last fifty years. The results revealed the importance of a small group of loosely connected frontrunners from across government, private, community and scientific sectors who, through a mix of creating and disrupting institutional strategies, managed to facilitate a growing and diverse actor-network that steered this transition over decades. The establishment of networked bridging organisations was also instrumental because they formed different types of networks and alliances over time for protecting and deepening the reach of the transition dynamics across the city. The findings suggest there is no single cause–effect relationship nor one dominant intervention or action that shifted the urban stormwater management regime. Rather, it showed that the co-evolutionary processes between the broader transitional dynamics were played into by frontrunners and their actor-networks in such a way that emerging new narratives diffused, giving meaning to the evolving scientific agendas and on-the-ground experiments, which led to new institutional structures and enabling administrative tools. It seems as though each one of these dimensions is as crucial as the other in explaining the outcomes of this successful sustainability transition.

1. Introduction

Many cities are serviced by three separate urban water infrastructure systems comprising water supply, sewerage and stormwater drainage. Urban stormwater drainage has primarily focused on providing engineered systems which promote efficient and flood-protected land development, through drains, pipes and/or channels to enhance hydraulic efficiency. This traditional water management regime became dominant in the second half of the 20th century and relied on transforming natural waterways (i.e. rivers, streams and floodplains) to increase their conveyance capacity and to act as receptacles and transporters of stormwater runoff and associated pollutants washed off from urban areas. This utilitarian approach to urban waterways reflects an earlier belief that waterways are environmentally and socially benign (Wong, 2006). Subsequent identification of a suite of negative economic, environmental and social outcomes (see e.g. Chocat et al., 2001; Brown, 2005) has not been able to shift this entrenched practice. Indeed, there is substantial evidence regarding the significant and diverse impacts of stormwater runoff on the health of receiving waterways (see e.g. Ellis, 1986; Roesner et al., 2001; Shuster et al., 2005; Walsh et al., 2005; Fletcher and Deletic, 2006) and contemporary research has identified a much broader range of societal values associated with urban waterways in relation to aesthetics, amenity, recreation, tourism, economic development, intrinsic ecological health, heritage and indigenous values (see e.g. Takahasi and Uitto, 2004; Jackson, 2006; Jackson et al., 2008).

Alternative infrastructure and management approaches for conveying and treating urban stormwater runoff using natural

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processes (such as constructed wetlands, swales and bio-retention systems) have been around since the mid-1980s (see e.g. Niemczynowicz, 1999; Burkhard et al., 2000). However, integrating and institutionalising these facilities into the urban form has proven to be highly complex and difficult to achieve: existing routines, infrastructures, institutions and cultures are persistent and highly interwoven. Research and demonstration have shown that when distributed throughout an urban environment this green infrastructure also serves to support biodiversity, healthy waterways, places of urban amenity, and corridors of safe flood conveyance (Wong and Brown, 2009). In this context, a widespread application of highly visible, distributed technologies within the urban landscape for multiple benefits should therefore be considered as a complex process of systemic change or transition.

Many cities worldwide have begun to pursue this more sustainable and multifunctional stormwater management approach, often under different labels including: water sensitive urban design (Australia), low impact urban development (New Zealand), low impact development (United States of America), and sustainable urban drainage systems (United Kingdom) (Marsalek and Chocat, 2002). Nevertheless, these approaches remain far from mainstream practice (Marsalek and Chocat, 2002; Gleik, 2003; Harding, 2006; Mitchell, 2006; Farrelly and Brown, 2011), with a handful of exceptions, such as Melbourne, Australia (e.g. Roy et al., 2008).

Such inertia is common across the developed world, with numerous scholars highlighting the systemic phenomenon of historical investment and socio-institutional routines of past practices preventing the adoption of better alternatives when they are available (Unruh, 2000; Walker, 2000; Pahl-Wostl et al., 2009; Brown and Farrelly, 2009; Brown et al., 2011). This problem of systemic lock-in is not unique to water (infrastructure) systems, and is also seen in other sectors (see e.g. Verbong and Geels, 2007), since socio-technical systems are largely stable areas of practice that are known to incrementally adapt and change over time, with only occasional major system-wide transformation under very specific conditions (Geels, 2004). Therefore, a significant challenge facing urban stormwater managers and policy makers is the limited knowledge and guidance regarding how to effectively address the significant issue of path dependency and to institutionalise alternative approaches, such as adopting passive urban stormwater quality treatment technologies (Brown et al., 2006; Saleth and Dinar, 2005).

The basic understanding of socio-technical (e.g. Rotmans et al., 2001; Loorbach, 2007) and socio-ecological (Folke et al., 2005; Olsson et al., 2006) transitions and their multi-level, multi-phase dynamics has provided the basis for thinking about 'sustainability transitions' and their governance. Sustainability transitions are considered long-term, multi-dimensional and fundamental transformation processes through which established socio-technical systems shift to more sustainable modes of production and consumption (Markard et al., 2012).

The socio-technical transitions scholarship provides rich insights regarding the architecture of the structuring dynamics involved in adopting alternative socio-technical pathways (e.g. Rotmans et al., 2001; Geels, 2002). This scholarship considers transitions to unfold when dynamics across the macro (landscape), meso (regime) and micro (niche) level of the socio-technical system 'move in the same direction' (Geels, 2002), and an entire transition to often take between 25-50 years. This general (non-linear) pattern of evolution occurs over four phases: predevelopment, take-off, acceleration and stabilisation (Table 1)(Rotmans et al., 2001), which are underpinned by complex interactions between actors, markets, networks, institutions, technologies, policies, individual behaviour and autonomous trends at varying scales in the economic, ecological, socio-cultural and institutional domains (van der Brugge and Rotmans, 2007). As a result, the strength, scope, speed and frequency of landscape pressure, stability of the regime and its ability to respond to pressures and the sophistication of niche innovations will create different transition pathways (van der Brugge and Rotmans, 2007; Geels and Schot, 2007).

Table 1
Description of the four key transition phases.

Transition phase	Description
Pre-development	Period of dynamic equilibrium where the status quo does not visibly change, but contestations begin to emerge.
Take-off	Phase where the process of change begins as a result of emerging innovation processes and technologies, which begins to destabilise the system.
Acceleration	Visible structural changes take place as a result of an accumulation of innovations in socio-cultural, economic, ecological and institutional domains which react to each other, facilitated by processes of collective learning, diffusion and embedding.
Stabilisation	The speed of social change decreases and a new pattern of system dynamics across socio-institutional and technology-environment reaches a dynamic equilibrium.

Source: Rotmans et ?al. (2001).

There has been increasing interest and a sustained call for clarifying the changing role of agency throughout such a transition, to provide critical insight into (amongst other rationales) how to best steer or navigate sustainability transitions in practice (such as physical infrastructure, operating procedures and behaviours) (Loorbach and Rotmans, 2010). Empirical analysis of actors and how they contribute to developing (creating and/or modifying) supportive institutional structures in sustainability transitions has attracted limited empirical attention and validation (Farla et al., 2012). In addition, there are unanswered questions around how these variables may relate to each other and change during the course of a sustainability transition (Grin et al., 2011).

Despite the notion that actively navigating a transition raises concerns (see e.g. Elzen and Wieczorek, 2005; Smith et al., 2005; Shove and Walker, 2007; Genus and Coles, 2008; Smith and Stirling, 2010) about issues such as the impact of the exclusion of some groups from the governing process, there have been a number of empirical studies on transitions in policy and ecosystem governance (as opposed to a socio-technical system transition). The work of Huitema and Meijerink (2010a,b) and Olsson et al. (2004a,b, 2006, 2008) are noteworthy for identifying the type and pattern of strategies employed by (groups of) individuals to enable desirable shifts in water policy and ecosystem governance. Further, a number of scholars have reported on a range of actor-related variables that are thought to influence transition pathways. These include, among others, leadership, networking, bridging organisations (e.g. Folke et al., 2005; Olsson et al., 2004a,b, 2006, 2008; Huitema and Meijerink, 2010a,b), facilitation, steering, coordination (e.g. Loorbach and Rotmans, 2006) and social learning (van de Kerkhof and Wieczorek, 2005; Pahl-Wostl, 2007; van der Brugge and van Raak, 2007; Bos and Brown, 2012).

However, it is important to note that sought-after changes in policy, ecosystem governance or organisational dynamics (the unit of analysis for many of the above cited studies), while significant, do not necessarily result in successful change in 'on-ground' practices or environmental conditions, and therefore the realisation of a sustainability transition. This relates to our understanding of policy as only one of the factors determining the outcomes of long-term societal change. Rather than seeking to understand how policy change takes place, we therefore ask how socio-technical