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Stormwater management in transition: The influence of technical and governance attributes in the case of Brussels, Belgium

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ABSTRACT

Worldwide, conventional stormwater management policies and practices are under pressure due to the malfunctioning of existing urban drainage systems, population growth, urbanisation and climate change. In response to these developments, we have seen an increase in the development and uptake of alternative actions. These actions often involve physical infrastructure moving from the underground to the surface and an increase of stakeholder interactions and involvement. We draw upon the literature on transitions of socio-technical systems to understand these changes in stormwater management policies and practices in the case of a local municipality in Brussels, Belgium. Building upon previous research by Rijke et al. (2013), we assert that every transition stage (early, middle, late) can be linked to typical activities. We particularly aim to understand how a transition process is influenced by technical attributes of actions, i.e. whether they are soft, green or grey, and by governance configurations, i.e. whether actions are more centralised or decentralised and more formal or informal. In doing so, we looked into the development, implementation as well as the diffusion of alternative actions. Our results show that in the early stage of transition, soft actions, such as manuals, legislation and economic incentives, prevail. In the diffusion of actions, decentralised processes and collaboration between formal institutions and informal networks play a key role. We further found that attention should be given to preventing the alienation of civil society during diffusion processes.

1. Introduction

In industrialised countries, drainage systems that were constructed in the 19th century are often no longer sustainable because of negative environmental impacts, such as urban flooding, waterway pollution and a decrease of biodiversity (Karvonen, 2011; Niemczynowicz, 1999). What characterises these systems is that they are governed by central decision-making authorities and use underground infrastructure to convey stormwater, as soon as possible, outside of urban areas (Chatzis, 1999). The environmental impacts and risks of these systems are growing due to increasing urbanisation and changing precipitation patterns (Gleick, 2000; Mitchell, 2006). As infiltration capacity is decreasing and extreme rainfall events are becoming increasingly common, the flow of polluted run-off, now increasingly often, overwhelms the drainage system (Niemczynowicz, 1999). In response to these challenges, so-called 'alternative' actions have been introduced. In the European context, the term 'alternative' action is used to contrast these approaches with conventional actions (Fletcher et al., 2014). In Australia, the term 'water sensitive urban design' is used to refer to similar approaches. What makes these approaches 'alternative' is that they are implemented with attention for the institutional and physical context of urban areas and ecological conditions (Schoeman et al., 2014; Tjallingii, 1996; Wong and Brown, 2009; Yu et al., 2012). In contrast to conventional approaches, they aim to manage stormwater at the surface, to reduce run-off and to avoid the pollution of waterways (Chocat, 2008; EEA, 2013; Hellier, 2015). Moreover, they are more decentralised and often driven by citizens and non-profit organisations (see Moretto and Ranzato, 2017). While conventional approaches heavily rely on 'grey' technical or engineering solutions, alternative actions are often characterised by 'soft' managerial, legal and policy approaches or 'green' ecosystem-based approaches (EEA, 2013). In practice, alternative actions are often an addition, rather than a substitute, to conventional actions (Chocat, 2008). This has to do with, on the one hand, the high quantity of stormwater to be managed and, on the other hand, the limited availability of land and the density of the existing urban fabric (Hoyer et al., 2012).

The application of alternative actions involves technical (e.g. infrastructure) and social changes (e.g. changing practices, regulations,

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policies, and networks). Urban drainage infrastructure is physically lifted from the underground to the surface, a place where civil society and non-profit organisations interact with administrative bodies and experts (Gandy, 2004). Since the integration of alternative actions into stormwater policies and practices involves structural changes in multiple elements, we understand this process as a transition of a socio-technical system, which encompasses technologies, institutions, rules, practices and networks (Smith et al., 2005). A transition involves structural changes in multiple elements of a socio-technical system (Brugge et al., 2006; Pahl-Wostl, 2008; Rotmans et al., 2001; Smith et al., 2010) and can be understood as a process consisting of multiple stages: early (pre-development, take-off), mid (acceleration) and late (stabilisation) (Rotmans et al., 2001; Rijke et al., 2013). Rijke et al. (2013) show that these early, mid and late stages can be associated with typical activities. For example, network formation is a typical activity in the early stage of a transition whereas regulation is typical in the late stage. A typical activity can include multiple actions, which have the same main objective (Rijke et al., 2013). For instance, the typical activity 'network formation' can include an action aiming to establish a working group composed of local and regional actors and another action aiming to organise a roundtable of discussion between different actors. Actions may contribute to a transition when they are diffused (Boulanger, 2008; Brown et al., 2013). Diffusion is understood here as the duplication and expansion of knowledge (artefacts, hard or soft knowledge) in new locations and/or institutionalisation (Vreugdenhil, 2010) and the capacity of actions to influence other actions (Boulanger, 2008).

Building upon transition and urban water management studies, we assert that the implementation and diffusion of stormwater actions are not only influenced by technical attributes, but also by the governance attributes that are associated with them (i.e. who manages water and how) (Brown and Farrelly, 2009; Niemczynowicz, 1999; Van de Meene et al., 2011). To understand the governance attributes of an action, we use the concept of 'governance configuration'. Stormwater governance is multi-levelled (i.e. a process carried out at different levels of the society) and polycentric (i.e. several actors have the capacity to influence the governance process) (Knieper and Pahl-Wostl, 2016; Pahl-Wostl, 2015). We consider the fit-for-purpose framework – an operational tool of multi-level and polycentric stormwater governance – to characterise governance configurations according to two dimensions: verticality (centralised and decentralised processes) and horizontality (formal institutions and informal networks) (Rijke et al., 2012). Verticality refers to the centrality of the initiating actor in the decision-making process (Rousseau, 2011). Horizontality characterises the relation between actors, including whether the action is initiated by formal institutions, which are under formal regulation, or informal networks (Pahl-Wostl, 2015). Even though researchers agree that governance configurations influence the diffusion of actions, yet few studies link governance configurations to technical attributes of actions and transition stages (Pahl-Wostl et al., 2011; Rijke et al., 2013; Van de Meene et al., 2011). Our study addresses this knowledge gap by providing an improved understanding of how the technical and governance attributes of alternative actions influence a transition process, including the moving from one transition stage to another through the diffusion of actions. We acknowledge that other attributes of actions may be relevant for a transition process, such as the visibility of an action. However, we focus on these two attributes as these also characterise the main differences between conventional and alternative actions.

We investigate the case of the municipality of Forest (French name) or Vorst (Flemish name) in Belgium where local administration, non-profit organisations, and community-based organisations have initiated and implemented alternative actions in stormwater management. Some of these actions are currently being diffused to other municipalities. Central in the case study are the following questions: What are the technical and governance attributes of actions that were recently developed or implemented to improve urban stormwater management? How do these actions correspond to the typical activities of a transition process? Which of the alternative actions are diffused and therefore contribute to wider change processes? The remainder of this paper is structured as follows. Section 2 presents the study's conceptual framework. Section 3 provides the research methodology. Section 4 presents the case study results. These results and their implications are discussed in Section 5. The final section presents our main conclusions.

2. Transition in urban stormwater management

Sustainability transitions are long-term processes in which socio-technical systems move towards a sustainable production and consumption of resources (Markard et al., 2012). We consider alternative actions here to be examples of socio-technical experiments that drive transition processes (Luederitz et al., 2016) and have technical and governance attributes (Sengers et al., 2016).

2.1. Technical and governance attributes of stormwater actions

To differentiate actions in terms of their technical attributes, we distinguish between soft, green and grey actions (EEA, 2013). In the stormwater management domain, green actions are on-ground, small-scale devices for harvesting, treating, infiltrating and reusing stormwater (e.g. swales, wetlands, rainwater gardens or rainwater tanks) in order to complement underground drainage pipes (Howe et al., 2011). Soft actions include guidelines, legislation, and manuals sustaining the application and integration of these devices in the current institutional and physical context (Hoyer et al., 2011) and often involve changes in water governance (EEA, 2013). In the literature, they have received less attention than green actions since their impact is difficult to assess (Taylor and Wong, 2002). Nevertheless, soft and green actions often support each other's implementation (Brown and Clarke, 2007).

Barriers to the implementation of alternative actions are not only of a technical nature, but are also rooted in prevailing governance structures, which are influenced by societal values, risk perceptions, individual factors and loss of culture (Adger et al., 2009; Brown et al., 2009; Niemczynowicz, 1999; Sharma et al., 2016; Van de Meene et al., 2011). Stormwater governance is polycentric and multi-levelled with actors and networks formulating and establishing policy at different levels of the society (Knieper and Pahl-Wostl, 2016; Pahl-Wostl, 2015). As a result, decision-making stances overlap and are interconnected both vertically and horizontally around the issue to be governed (Bulkeley and Betsill, 2005; Hooghe and Marks, 2003). In polycentric systems, new governance configurations may appear at the local level as a result of the relations that form between state and non-state actors (Bulkeley and Betsill, 2005). We use the term 'governance configuration' as the combination of two dimensions of multi-level governance: verticality and horizontality.

The first dimension of a governance configuration, verticality, refers to the centrality of the initiating actors from an administrative and political perspective. The initiating actor of an action can belong either to the centralised decision-making system or to the decentralised decision structures. Centralisation relates to the unity and hierarchy imposed by the State in the process of decision-making (Rousseau, 2011). Decentralisation of administrative and political power occurs when the State gives local collectives (such as local councils) the ability to organise and manage certain local affairs (Bardhan, 2002; Pahl-Wostl et al., 2006; Tellier, 1969). Decentralised processes are recognised in the literature on sustainability transitions as key in empowering local councils to influence the contribution of actions to transition (Kemp et al., 1998).

The second dimension, horizontality, refers to whether the action was initiated by formal institutions or informal networks. In this paper, we start from the premise that all individual actors, either state or non-state actors, are part of an established group of influence. Formal institutions, in a broad sense, refer to the official regulations and