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Social construction of stormwater control measures in Melbourne and Copenhagen: A discourse analysis of technological change, embedded meanings and potential mainstreaming

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ABSTRACT

Urban stormwater systems in cities around the world are challenged by urbanization and climate change, and a range of Stormwater Control Measures (SCMs) are being implemented as solutions to these challenges. We developed a conceptual framework of technological stabilization based on Social Construction of Technology (SCOT) and Transition Science, and conducted 16 in-depth actor interviews as a basis for mapping the historical development of in the two cities. The SCMs applied in Melbourne and Copenhagen are similar, but using a new framework for technological stabilization we identify differences in their application due to different physical, organizational and cultural contexts in the two cities, drought being the main driver during the past decade in Melbourne (1997–2010) and pluvial flooding in Copenhagen (2007-). In Melbourne there is currently a strong integrated understanding of SCMs: after decades of "new technology" development, "testing" and "opportunity" seeking a large degree of "agreement" about stormwater management as a mainstreamed professional practice has arisen. In Copenhagen there are currently multiple conflicting understandings of SCMs and signs of an emerging integrated understanding that offers "opportunities" for further development and implementation. It is clear from Melbourne's history that: successful full scale demonstration projects supported and developed by a wide range of actors helps building a common vision for SCM technologies, supportive policies across several governmental levels provide incentives for implementation, and inclusive actions in the closure process provides a sense of ownership for SCM technologies across disciplines.

1. Introduction

Urban stormwater systems in cities around the world are challenged by urbanization and climate change. This leads to problems in multiple places of the management of the urban water cycle; including issues such as drought, flooding and poor water quality (Chocat et al., 2001). Copenhagen and Melbourne are two cities on opposite sides of the earth, which experience these kind of challenges but yet in recent years have been voted as some of the most livable cities in the world (Leigh, 2014; The Economist Intelligence Unit, 2015), celebrated for their green, sustainable and participatory approaches to urban planning and urban life. Both cities have been given these awards despite the experienced problems with the urban water cycle, a changing population, parallel urban expansion and densification, and climatic changes. Specifically, Copenhagen has experienced flood damages of more than 800 million EUR in one very large cloudburst event and Melbourne had significant losses not only in farming and industry but also in the everyday lives of urban citizens due to e.g. fire and watering bans(Brown and Clarke, 2007; Institut for Beredskabsevaluering, 2012). Seemingly, both cities have seized the opportunity for positive change created by these challenges, but the detailed mechanisms are so far unexplored.

In Copenhagen, Melbourne and several other cities around the world it is attempted to use green and sustainable stormwater technologies to solve the experienced problems of the urban water cycle (Chocat et al., 2001, 2007; Mitchell, 2006). Fletcher et al. (2015) suggested the term Stormwater Control Measures (SCM) to encompass the wide variety of global terminology encompassing these solutions, which is still evolving and now includes "Nature-based solutions" in Europe (Kabisch et al., 2016) and the "Sponge city" concept in China (Gaines, 2016). In Australia these technologies are called "Water Sensitive Urban Design" (WSUD) solutions and in Denmark they are called "Lokal Afledning af Regnvand" or "Lokal Anvendelse af Regnvand" (Local Rainwater Drainage or Local Use of Rainwater – LAR). The basic technologies involved in WSUD and LAR solutions are very similar (Fletcher et al., 2015) even

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though they may bear different names and be used for different purposes (see Fig. 5 for further details). In this paper, the term LAR is applied to the Danish setting, the term WSUD to the Australian setting, and the term SCM is used in contexts that encompass both the other two terms.

WSUD is defined as an integration of urban planning with the management of the urban water cycle, and therefore incorporates several values, considerations and goals that mostly relate back to the term sustainable development (Fletcher et al., 2015; Wong, 2007). Behind the broader principles are the specific technologies (Fletcher et al., 2015). WSUD systems consist of different elements, here also referred to as technologies or SCMs, and a combination of several WSUD elements in a treatment train will result in a stormwater management system. The SCMs are different but they are all to some extent based on the following hydrologic processes: detention, infiltration or harvesting, evapotranspiration, transport and treatment (Engineers Australia, 2007). LAR can be defined as any initiative that controls rainwater and stormwater locally and therefore reduces the amount of water led to the piped sewerage system (Aabling et al., 2011). LAR is connected to urban ecology and therefore also perceives stormwater as a local resource (Anthonisen et al., 1992; Lützen et al., 1994). Like for WSUD, LAR consists of different elements, and a combination of these elements results in a stormwater management system. The SCMs involved in LAR are based on the same range of hydrological processes as mentioned above for WSUD (see e.g. Københavns Kommune, 2010a).

Especially the story of Melbourne's urban stormwater system has been well investigated as part of a larger study of integrated approaches (Mitchell, 2006) and with specific focus on the transition towards a Water Sensitive City (Brown and Clarke, 2007; Brown et al., 2013; de Haan et al., 2014; Ferguson et al., 2014). The story of Copenhagen's urban stormwater system has recently been investigated in relation to climate change planning (Fratini et al., 2012a) and in relation to the narrative of harbor bathing (Jensen et al., 2015). The aim of this study is to compare the development in these two cities towards stabilization of stormwater management as a mainstreamed professional activity addressing often mentioned challenges such as drought, flooding and poor water quality, to establish a basis for further development of innovation and implementation of SCMs. Main focus is on the technological change and embedded meanings related to the applied SCMs and the actors connected to these. For this purpose we first develop a conceptual framework of stabilization based on Social Construction of Technology (SCOT) and Transition Science, identifying the four typical stages "new technology", "testing", "opportunity" and "agreement". We then draw parallels between the SCMs used in Melbourne and Copenhagen and apply the new framework for analyzing 16 in-depth actor interviews and supportive literary sources, in order to identify how far the stabilization process has come in the two case cities. Finally we compare and discuss the underlying drivers of development in the two cities and the role of actors, full-scale demonstration projects, and supportive policies and institutions for mainstreaming of WSUD and LAR – and thus SCMs in general - in urban stormwater management.

2. Theory and method

2.1. Research design

The overall research design of the study was based on two types of data: primary and secondary data. The primary data consisted of in-depth actor interviews that were supported by secondary data in the form of literature. Fig. 1 shows the flow of the overall research design. An initial study of literature on Social Construction of Technology (SCOT) and Transition Science as well as grey literature for both case cities was used to conceive a conceptual stabilization framework and to structure the interviews. Primary interview data were then collected and analysed in distinct rounds for each case city. Finally a comparative historical analysis was made of the two data sets using the proposed conceptual framework.

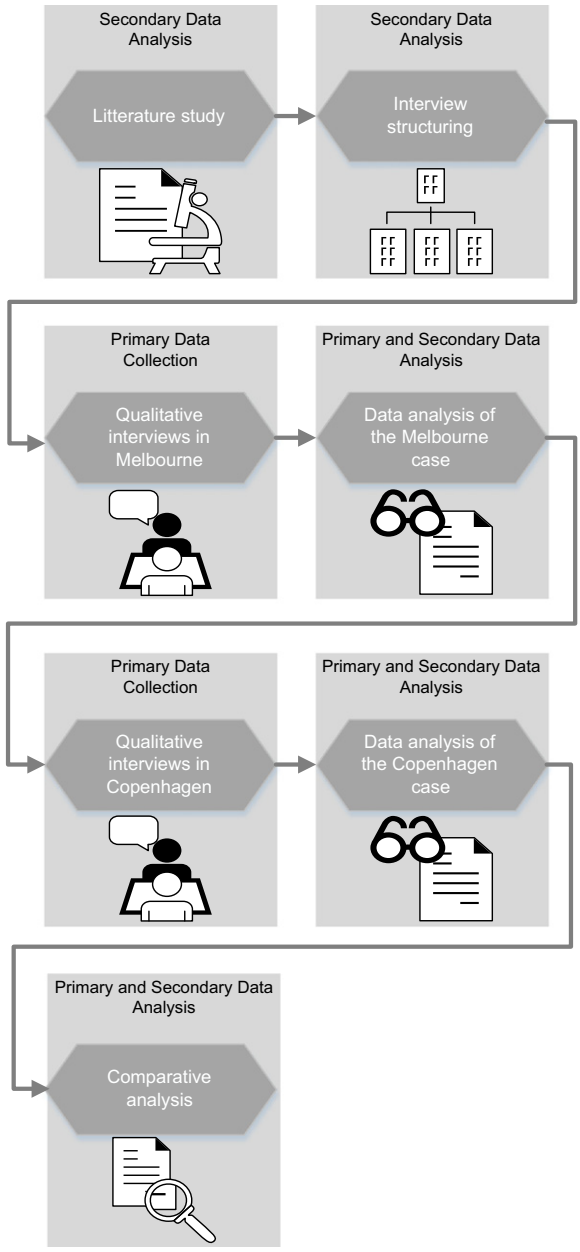

Fig. 1. Research design structure of the study.

2.2. Social construction of technology in the context of innovation and technology studies

The socio-technical analysis framework SCOT (Social Construction of Technology) was used to examine the stabilization process of WSUD in Melbourne and Copenhagen. SCOT is aimed at analyzing changes in a socio-technical system and originates in Science and Technology Studies (STS). SCOT was chosen because it is the negotiation between the human actors in the technological development process that is in focus in this study. However, SCOT can also be related to the newer scientific fields of Transition Science (TS) and Innovation Systems Science (ISS) in the way that SCOT takes a more "specific focus on technology" (Markard et al., 2012) in the analysis of a transition of a socio-technical system. SCOT, TS and ISS all take as a starting point that technology is developed through a competition of different designs in a