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Lost in Transactions: Analysing the Institutional Arrangements Underpinning Urban Green Infrastructure

Gayathri Devi Mekala[a], Darla Hatton MacDonald[b,*]

[a] University of Melbourne, Parkville Campus, Melbourne, Victoria 3010, Australia
[b] Tasmanian School of Business and Economics, University of Tasmania, Private Bag 84, Hobart, Tasmania 7001, Australia

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ABSTRACT

Urban development has altered surface-water hydrology of landscapes and created urban heat island effects. With climate change, increasing frequency of extreme heat events and in some areas, episodic drought and flooding, present new challenges for urban areas. Green infrastructure holds potential as a cost-effective means of providing microclimate cooling and stormwater diversion. Further, green open spaces when combined with the provision of equipment and facilities have the potential to promote physical and emotional well-being. However successful implementation may be predicated on co-ordinated efforts of multiple agencies. The Institutional Analysis and Development framework developed by Crawford and Ostrom is used in a case study to understand the institutional impediments, transaction costs and gaps in responsibility associated with the delivery of green infrastructure. Lessons learned are potentially transferable to other urban settings. Our analysis reveals areas of high transaction costs as well as a gap in the polycentric decision-making of agencies. The local government council is concerned with the well-being of its residents but has limited financial capacity. None of the agencies who deliver green infrastructure have responsibility for facilitating the indirect or preventative health benefits. Thus, a co-ordination problem among agencies can lead to suboptimal investments in green infrastructure.

1. Introduction

Worldwide the increasing pressures of urbanisation (Schaffler and Swilling, 2013), chronic under-investment in urban infrastructure (Nandi and Gamkhar, 2013) and the changing frequency of extreme weather conditions (drought, flooding and sustained hot weather events) demand a reconsideration of how infrastructure and services are delivered. While there will always be a role for grey infrastructure (concrete and bitumen), a case can be made for green infrastructure (GI) as a potentially cost-effective solution while enhancing the provision of urban ecosystem services (Palmer et al., 2015; Mekala et al., 2015; Gómez-Baggethun and Barton, 2013; Tzoulas et al., 2007; Bolund and Hunhammar, 1999). GI is defined, for the purposes of this study, as any area within the urban environment dedicated to elements of green vegetation that mitigate the impacts of urbanisation and includes elements such as wetlands, tree canopies, parks/gardens, and large conservation zones, providing ecosystem services such as amenity, recreational values, habitat services as well as improvements in air and water quality (Tzoulas et al., 2007; Weber et al., 2006). Ecosystem services are increasingly recognised as the benefits from nature which make life worth living and defined broadly as provisioning (food and materials), regulating (mitigation of environmental conditions), cultural (aesthetic and psychological benefits) and supporting services which underlie all ecosystem services (Bateman et al., 2013).

GI projects are generally implemented at the scale of neighbourhood or local government planning area as part of the development of greenfield sites or redevelopment of existing land uses. By its nature, GI is a decentralised solution shaped by institutional arrangements which support or impede the delivery of localised services. In this article, our focus is on open space GI providing ecosystem services to people. Further, it is useful to employ a broader definition of GI that includes natural vegetation combined with equipment/facilities. A park with bike paths can provide multiple benefits with habitat services through native vegetation, water quality benefits from intercepting stormwater with permeable grassed areas as well as the recreational/health benefits (Brown et al., 2014).

The aim of this study is to identify the key institutional factors that contribute to the development of more livable urban spaces using an Australian case study. The study uses the Institutional Analysis and Development (IAD) framework and seeks to (1) understand the

* Corresponding author.
E-mail addresses: Gayathri.Mekala@unimelb.edu.au (G.D. Mekala), Darla.HattonMacDonald@utas.edu.au (D. Hatton MacDonald).

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contextual conditions that shape GI including the policy environment, community attributes and physical and biological systems; (2) assess the extent of interactions/collaborations between different actors and type of decisions made with respect to GI management; (3) evaluate the effectiveness of the key actors with respect to different policy outcomes and the indicators used to assess these outcomes; and (4) to evaluate the potential gaps in responsibility and decision-making.

2. Methods

Numerous frameworks exist for evaluating planning and natural resource management encompassing social relationships and the physical environment. In the context of urban water, Hellström et al. (2000) proposed a systems analysis for examining sustainability indicators (health, social-cultural, economic, environmental and technical system operations). Management approaches (e.g. Ferreira and Otley, 2009) focus on internal performance criteria for managing within organisations. Social-ecological systems approaches have been proposed by Hoffman (2003) and Ostrom (2009). However all these approaches fall short in the degree to which the institutional setting and contextual nature of the problem have been incorporated. The Institutional Analysis and Development (IAD) framework (Crawford and Ostrom, 1995) provides an encompassing systems view of the policy/institutional setting, economic and social/cultural aspects interacting with the physical environment. The focus is on understanding the interconnected rules/norms within and between organisations in a societal context (Crawford and Ostrom, 1995). In particular, "frameworks serve as a meta-theoretical schema that facilitate the organization of diagnosis, analysis, and prescription" (Ostrom et al., 2017, p 51). The IAD framework is flexible and as a result has been applied widely in areas such as public health (Bailey, 2014), conservation programs (Morrison and Hardy, 2014), nanotechnology consortia (Allarakhia and Walsh, 2012) and immigration policy (Lam, 1997).

The IAD framework defines institutions as "enduring regularities of human action in situations structured by rules, norms, and shared strategies, as well as by the physical world" (Imperial, 1999, p 453). Institutions influence and are in turn, influenced by the broader policy environment, the attributes of the community and the bio-physical aspects of the geographical area. These combined conditions provide the contextual conditions of the analysis (see Fig. 1). Within this framework, the unit of analysis is the action arena/situation which includes individuals and organisations that make decisions. The researcher explores how a group of individuals (or organisations) confront a problem and the rules they adopt to address it (Imperial, 1999). Further, the researcher assembles contextual attributes, the 'rules-in-use', and patterns of interaction to explore hypotheses (Ostrom et al., 2017).

Although GI is one integrated ecological unit in principle, its management is segregated and divided among different actors based on institutional boundaries. Actors (e.g., local government, state government agencies) will have a regularised way of decision-making and a key question for researchers is how to uncover the knowledge the various actors have concerning the policies, individual agency actions and collaboration among actors (Ostrom et al., 2017). To this end, this study uses in-depth interviews to assess and test propositions concerning actions and outcomes (Ostrom et al., 2017). In particular, the effectiveness of the actors in delivering the outcomes can be measured by selected indicators including indicative transaction costs.

In this application to GI, the data and information required for this study was collected from primary and secondary sources, using a mixed methods approach (Creswell, 2014). Initially an online search was conducted to identify the key formal and informal stakeholders who manage different types of GI. Document analysis of annual reports, policy/strategy documents, organizational websites and online feedback forums to uncover roles, responsibilities and stances with respect to GI was undertaken. Additional documents were identified by internet search and by requesting relevant policy documents. In-depth interviews were used to untangle the formally reported contextual conditions from the culture and norms of the people in agencies (Brimbank City Council, Melbourne Water, City West Water and Vic Roads). Additional interview participants were recruited by expertise domain (e.g. native vegetation expertise, research/consulting, community, Friends groups, neighbouring council) using a snowball sampling method which is appropriate to a case study. Interviews were conducted with 13 experts and practitioners using a script with questions relating to GI. Questions included (1) professional opinion of the participant with respect to the quantity, quality, utility and ecological value of GI in the council area; (2) community consultation processes of the organisation; (3) extent of collaboration with other stakeholders; and (4) transaction

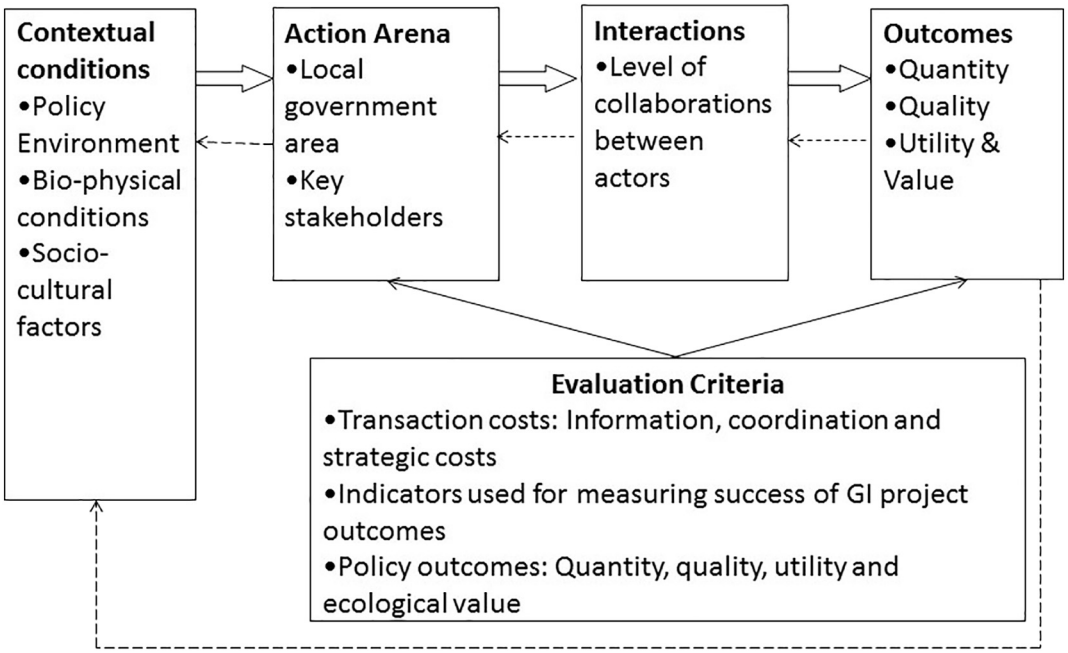

Fig. 1. The Institutional Analysis and Development Framework.
Source: Ostrom (2005) framework - adapted for institutional analysis of GI.