Delivering sustainable urban water management: a review of the hurdles we face

R. R. Brown and M. A. Farrelly

ABSTRACT

Sustainable urban water management (SUWM) requires an integrated, adaptive, coordinated and participatory approach. Current urban water policies are beginning to reflect this understanding yet the rhetoric is often not translated to implementation. Despite the 'new' philosophy, urban water management remains a complex and fragmented area relying on traditional, technical, linear management approaches. Despite widespread acknowledgement of the barriers to change, there has been little systematic review of what constitutes the scope of such barriers and how these should be addressed to advance SUWM. To better understand why implementation fails to occur beyond ad hoc project interventions, an extensive literature review of observed and studied barriers was conducted. Drawing on local, national and international literature from the field of integrated urban water management and other similar fields, 53 studies were assessed, resulting in a typology of 12 barrier types. The analysis revealed the barriers are largely socio-institutional rather than technical, reflecting issues related to community, resources, responsibility, knowledge, vision, commitment and coordination. Furthermore, the meta-analysis demonstrated a paucity of targeted strategies for overcoming the stated institutional barriers. Evaluation of the typology in relation to capacity building suggests that these systemic issues require a sophisticated programme of change that focuses on fostering social capital, inter-sectoral professional development, and inter-organisational coordination.

Key words | barrier typology, capacity building, institutional change, socio-institutional impediments

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INTRODUCTION

It is widely accepted that, for the urban water sector to transition to sustainable urban water management (SUWM), a shift from the traditional, linear, 'old-world' approach to an adaptive, participatory and integrated approach is required. SUWM can be considered both a philosophical and technical approach that can be incorporated in all forms of urban re/development. The idea of managing urban water as a 'total water cycle' is confronting for it challenges traditional and technical management practices. Mitchell (2006) suggests that 'new' forms of management emphasise 'demand management and supply, using non-traditional water resources and the concept of fit-for-purpose and decentralisation'. Current urban water policies are beginning to reflect this philosophy, yet the rhetoric is often not translated into practice, with consistent failure to go beyond *ad hoc* demonstration projects (Harremoes 2002; The Barton Group 2005; Harding 2006; Mitchell 2006).

Industry commentators have long identified that barriers exist to transitioning to SUWM and that these impediments are not generally technological, but are, instead, socio-institutional (see Marsalek *et al.* 2001; Vlachos & Braga 2001; Brown 2005). Indeed, Wong (2006) suggested that, to advance SUWM technologies, an

doi: 10.2166/wst.2009.028

understanding of the socio-institutional aspects of governance is required. More recently, authors have identified that 'institutional inertia' is responsible for the slow pace of change, yet there is still little understanding on how best to overcome this (Imperial 1999; Brown *et al.* 2006*a*). Perhaps this situation is exacerbated by a lack of understanding of the overall scope and inter-relatedness between the range of institutional barriers that have been observed so far. There is no doubt that continuing with the status quo not only perpetuates the inefficient use of resources and continuing waterway degradation, but also continues to reinforce this so-called institutional inertia. Therefore, understanding the scope of this inertia is a productive starting point for considering the development of future initiatives for effectively diffusing the practice of SUWM.

Water industry commentators have expressed the need for programmes of change involving institutional structures, settings and processes since at least the mid 1990s. Indeed, Geldof (1995) called for more adaptive, integrated water management and Neimczynowicz (1999) considered the future challenge for urban hydrology was to 'organise cross-sectoral cooperation between multiple actors to introduce innovative technologies, management systems, and institutional arrangements which can meet multiple objectives'. Yet, in Australia, there has been little change within the urban water industry's institutional framework, despite waves of government-led, efficiency-focused reforms (McKay 2005). While reforms have been varied in scope and implementation, few gains have been achieved and the pace of change considered too slow. This paper contends that the many ongoing institutional barriers identified by authors are not well understood in terms of their scope. Therefore, if reforms are to continue in Australia as intended through the National Water Initiative, without a better understanding of the barriers and ways to overcome them, then further reforms may not achieve what is required to address institutional inertia.

Therefore, the purpose of this paper is to review the many barriers identified in the literature and categorise them against an institutional capacity assessment framework in an effort to improve our knowledge regarding the scope of institutional barriers. The purpose of aligning the barriers against an institutional capacity assessment framework is to identify any particular patterns or trends in relation to the four spheres of institutional capacity. It is beyond the remit of this paper to specify strategies to overcome the barriers; however, it is expected that comparing the barriers against the capacity framework will reveal appropriate capacity building interventions to assist urban water managers and strategists to develop better targeted, socio-institutional capacity building programmes. First, the paper will define institutions, institutional barriers and institutional capacity. Next, findings of the literature review are presented and discussed, followed by concluding comments.

Institutions and institutional barriers

Institutions are an expression of the formal and informal rules and norms that shape the interactions of humans with each other and with the environment (Cortner 1998). Social values and institutions are closely linked; values of the past create institutions of the present, while changing values will affect institutions of the future (Cortner 1998; Dovers 2001). Similarly, Saleth & Dinar (2005) commented that institutions, in a water context, are 'subjective, path dependent, hierarchical and nested both structurally and spatially, and embedded within the cultural, social, economic and political context'. Therefore, an institutional impediment can be defined as 'barriers that arise from political, social, legal or managerial constraints' (Lee 1999).

Understanding what promotes, hinders or alters the implementation of good policy and new technology helps to evaluate policy and institutional efficacy in SUWM (Dovers 2001); hence the importance of understanding the socio-institutional dimensions of perceived/ identified barriers. As Wong (2006) pointed out, research has so far been directed towards technological advancements over socio-institutional dimensions that could assist the implementation of such technologies and help support current reform efforts. By understanding the multiple barriers and their interactions, the industry can begin to move beyond isolated strategies and begin tackling the barriers simultaneously and strategically (Brandes & Kriwoken 2006).

Recently, a group of Australian environmental industry leaders, The Barton Group (2005), argued the industry needs new institutional rules, tools and organisational arrangements to enable the necessary water industry

reforms 'from one that is focused on water extraction to one that manages the water cycle and inter-connects water bodies sustainably'. Yet, despite these calls for change, there has been little transformation within the urban water industry's institutional framework. One explanation may be the inherent complexity involved in dealing with interdisciplinary, inter-organisational and sustainability focused issues. Indeed, Briassoulis (2004) contends that the inherent complexity in environmental policy and planning problems and the associated implementation difficulties are profoundly influenced by the complexity of their institutional setting and she advocates for institutional change over structural rearrangement. Similarly, Mitchell (2005) identified the embedded complexity in water management and also supports the concept of institutional change. While authors argue for institutional change and the strengthening of legitimisation processes rather than fundamental structural changes, institutions are often not 'ready or willing' to adapt, particularly without a secure business case. Understandably then, while the institutional dimensions of SUWM are already recognised as a challenge, the institutional impediments are yet to be systematically addressed.

To encourage institutional change, understanding institutional capacity is vital. Building capacity is important for it determines the ability of an institution to perform effectively at its own (internal) tasks and in cooperation and coordination (external) with others in its field (Wakely 1997). Too often capacity-building programmes are targeted at the more politically expedient areas of human resources (i.e. skills development, training); however, institutional capacity building requires more than this (Grindle & Hilderbrand 1995). As Brown *et al.* (2006*b*) argued, there are few practical tools available to assess capacity needs. Therefore, using the tentative institutional capacity assessment framework by Brown *et al.* (2006*b*), the aim of this paper is to assess and categorise the range of observed barriers against the necessary institutional capacity building components following an extensive meta-analysis of existing studies. The purpose of creating such a typology is to provide urban water strategists with better information to assist them in targeting capacity building interventions and therefore expedite SUWM reform initiatives.

RESEARCH APPROACH

Developing the 'typology of institutional barriers' involved a two step process: 1) a systematic review of 53 studies on barriers, challenges and impediments, and 2) a thematic evaluation of these barriers in relation to an institutional capacity assessment framework proposed by Brown *et al.* (2006*b*).

The extensive literature review initially involved a broad critical examination of the existing body of urban water-related literature (also drawing from knowledge developed in the broader integrated catchment/environmental management fields) to identify trends, patterns and key concepts in relation to institutions and observed barriers to change. Next, to ensure the appropriateness and reliability of the papers reviewed, a set of selection criteria were carefully formulated. The study had to be: peer-reviewed, empirical (including in-depth case study analysis and/or expert commentary) and analytical (discuss and draw conclusions regarding barriers). Not to exclude important insights from work produced by industry professionals, selected published literature from conferences, book chapters and industry reports were also reviewed. For each of the 53 papers reviewed the following information was identified: the location of the study (i.e. Australia, Canada and New Zealand); the research methods employed (quantitative or qualitative); the level of analysis (i.e. single organisation, multiple organisation, external framework); the barriers identified, and the strategies for overcoming the barriers (due to page limit restrictions not all 53 references are listed). The review revealed a comprehensive list of 36 common and discrete barriers, which were systematically condensed to key institutional barrier 'types' based on relevant discussions regarding the scope of the barrier within the literature. These barrier types were then assessed according to the institutional capacity assessment framework.

There is currently no empirically grounded assessment framework for identifying institutional capacity needs; indeed, van de Meene & Brown (2007) are currently investigating this knowledge gap. This paper adopts the tentative institutional capacity assessment framework proposed by Brown *et al.* (2006*b*) to assist in the evaluation of barriers. The framework was considered an appropriate basis, for it builds on earlier work by Grindle (1997) in the

much broader field of public administration. The framework consists of four parts or 'nested spheres' of institutional capacity including: human resource development; intra-organisational capacity; inter-organisational capacity; and external institutional rules and incentives (Figure 1). An important element of this framework is the identification of possible capacity building interventions to address capacity deficits. By assessing the barrier 'types' according to the institutional capacity assessment framework, it is expected that appropriate capacity building interventions could be identified.

RESULTS

Overall, the results of the literature review produced a comprehensive list of 36 barriers which are not reported here due to paper length limitations. The barriers were subject to systematic review, based on discussions about each barrier in the studies reviewed, and subsequently reduced to 12 barrier types listed below:

- Uncoordinated institutional framework;
- Limited community engagement, empowerment & participation;
- Limits of regulatory framework;
- Insufficient resources (capital and human);
- Unclear, fragmented roles & responsibilities;
- Poor organisational commitment;
- Lack of information, knowledge and understanding in applying integrated, adaptive forms of management;
- Poor communication;
- No long-term vision, strategy;
- Technocratic path dependencies;
- Little or no monitoring and evaluation, and
- Lack of political & public will.

It is important to highlight that these barriers are socio-institutional rather than technical. For example, the barrier types reflect impediments related to community, resources, responsibility, knowledge, vision, commitment and coordination, rather than the current state of the technical feasibility of proposed solutions. The outcomes of the evaluation of barriers against the institutional capacity assessment framework are presented in Table 1. The shaded areas connect an individual barrier to an appropriate capacity building intervention category based on the discussion describing the impediment in the body of literature reviewed and the focus of analysis (e.g. a single organisation or interaction amongst organisations).

While many of the papers identified multiple barriers, the most commonly identified impediment was the lack of a coordinated institutional framework (40% of papers),

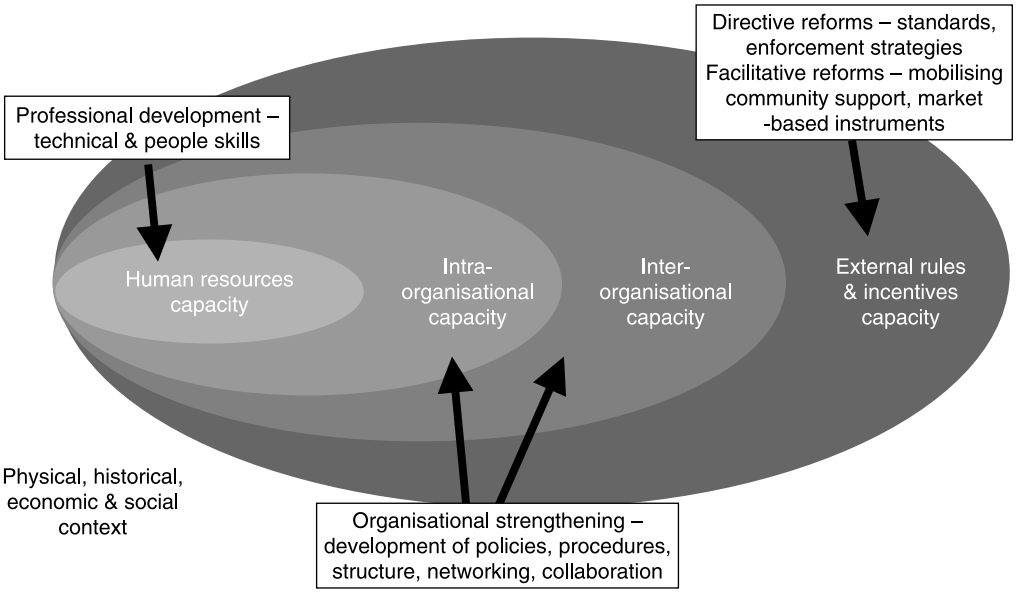

Figure 1 | Institutional Capacity Assessment Framework Source (Brown *et al.* 2006*b*).

Table 1 | Institutional Barriers Typology–identifying capacity-deficit target areas

	Institutional capacity assessment framework			
Barriers	**Human resources[1,4]**	**Intra-organisational capacity[2,4]**	**Inter-organisational capacity[2,4]**	**External Institutional rules and incentives[3,4]**
1. Uncoordinated institutional framework				
2. Limited community engagement, empowerment & participation				
3. Limits of regulatory framework				
4. Insufficient resources (capital and human)				
5. Unclear, fragmented roles & responsibilities				
6. Poor organisational commitment				
7. Lack of information, knowledge and understanding in applying integrated, adaptive forms of management				
8. Poor communication				
9. No long-term vision, strategy				
10. Technocratic path dependencies				
11. Little or no monitoring and evaluation				
12. Lack of political & public will				

1 = Professional Development 2 = Organisational Strengthening 3 = Facilitative Reforms 4 = Knowledge Building. Modified from Brown *et al* (2006*b*)

with the studies revealing poor inter-organisational collaboration and coordination. Poor community participation was the next most commonly identified barrier (38% of papers). Commentators suggested community members are often not considered as valid decision makers and therefore not informed (made aware) or empowered (engaged to act) to participate meaningfully in decision-making processes. The third most significant barrier, identified by 32% of the studies, was in relation to how the regulatory framework retarded the application of SUWM. In particular, issues included inconsistent regulatory approvals processes, conflicting formal mandates amongst organisations, unclear property rights, and the lack of authority/power of operational organisations to implement SUWM alternatives, often resulting in organisations being more reactive rather than reinforcing a proactive operational culture.

Limited resources, fragmented roles and responsibilities, poor organisational commitment and a lack of available information were equally recognised as barriers in 28% of the papers reviewed. Resources refer not only to sufficient funds but also the lack of skilled, experienced and knowledgeable individuals. Limited available information referred to the poor development of guidelines, standards and lack of documentation regarding design, construction, maintenance, monitoring and evaluation. This category also refers to an industry-wide lack of experience and knowledge in implementing/operating integrated, participatory, co-ordinated and adaptive management. Fragmented and unclear roles and responsibilities relate to not only internal issues within organisations, but also between and among other organisations. Poor communication processes were also identified (19% of papers reviewed) within, between and among organisations.

Lack of a sector-wide vision or cohesive strategies was recognised as a barrier. Within this category, tensions between short-term and long-term planning were revealed, along with issues in project-based interventions as opposed to on-going programmes (19%). Impediments due to technocratic path dependencies were recognised in 17% of papers reviewed and predominantly by social researchers who identified traditional, inflexible management cultures. Technological path dependency encapsulates the urban water industry's conservatism and reliance on traditional, highly visible solutions rather than attempt new 'ways-of-doing', for example, using non-structural measures. A lack of monitoring and evaluation was recognised as an impediment (15%), and finally a lack of public and political will (9%) was identified as retarding SUWM practices. For example, while government funding is often available, in some studies it was not matched to the requisite leadership, normative commitment or subsequent improvement in policy and management cultures.

Despite the multiple barriers identified, there were surprisingly few authors who proffered strategies for overcoming these barriers. In all, only 13 of the 53 studies examined presented explicit strategies for overcoming the identified barriers in their article. For example, Lee (1999) proposed undertaking a review of current systems by an independent science authority, working to improve collaborative management amongst hierarchical and vertical institutions and developing effective means for communicating. The greater majority of authors, however, offered more generic and broad scale suggestions of the need for more adaptive, collaborative, participatory and/or integrated management which lack sufficient prescription to enable a new programme of action. Indeed, many authors offered solutions counterpoint to the barrier(s) identified. For example, if the barrier was 'lack of organisational coordination', then 'improved organisational coordination' was often the 'strategy' suggested to overcome the barrier.

DISCUSSION: TOWARDS SUWM PRACTICES

Reviewing the results of the relationships between the barriers and the spheres of institutional capacity as shown in Table 1, it is clear that a significant majority of the barriers relate to 'inter-organisational capacity' and 'external rules and incentives'. Therefore it is not surprising that the topics of institutional inertia and barriers to change have become an increasingly prominent concept within the urban water literature. This is because these types of capacity deficits are pervasive and cannot be easily addressed through simple project, programme or champion interventions. Rather these barriers can only be addressed through programmes of change targeted at the systemic and embedded cultures, structures and relationships of current institutions of urban water management.

Therefore, until there is a sophisticated and dedicated programme of socio-institutional change it is unlikely that the widespread practice of SUWM will be realised. Given this, it is interesting to note that many of the current government funded capacity-building programmes, particularly those across Australia, are primarily focused on the first (human resource capacity), and occasionally the second (intra-organisational capacity), spheres of institutional capacity. Of note, human resource capacity was not shown to be the most significant capacity deficit; therefore, while focusing current resources on developing professional skills and understanding at the human resources level is likely to be a worthy enterprise, it is also unlikely to produce expedient results without attention to also developing inter-organisational and external incentive capacities for SUWM.

Yet, while each of the 12 barrier types is well recognised, they are also highly inter-dependent, and therefore likely to be less responsive to mutually exclusive programmes of change. This interdependence is cyclic; for example, when there is a 'fragmented regulatory framework' there are likely to be inconsistent and multiple organisational roles and responsibilities, thus promoting 'poor organisational commitment'. Therefore policy and legislative developments will also be informed in fragmented and contested ways, reinforcing the underlying impediment – often resulting in 'technological path dependency'. A number of sustainability theorists would argue that such fragmentation is further reinforced by a lack of a 'long-term vision', which not only reflects poor political will but further engenders a lack of agreement on what is valuable and therefore what should be subject to 'monitoring and evaluation'.

Suggesting there is a need for more integrated, participatory and adaptive management as a strategy for

overcoming the barriers to SUWM does little for helping industry understand how to tackle the specific and inter-dependent barriers identified above. Even starting from the current action space of human resource capacity building programmes, Brandes & Kriwoken (2006) warn that changing skills, knowledge and perhaps behaviours through education programmes, while useful, often overlooks the importance of understanding the pre-existing and broader barriers that limit the desired programme change in the first place. Therefore, it would seem that these largely human-resource capacity building programmes should also be providing key players with knowledge of current socio-institutional barriers and assisting them with understanding the limitations of their current socio-institutional context and operating environments. This is likely to be the most plausible first step in addressing these systemic and embedded barriers – i.e. raising awareness and potentially a new resource of advocacy for change particularly among the professionals involved in improving and reshaping SUWM. Given that the heart of these systemic issues relates to facilitating the necessary will and commitment across all stakeholders and associated administrative frameworks with SUWM, adapting current human resource capacity building programmes is likely to make a good first step at tackling this challenging phenomenon.

Overall, the typology of barriers could be used by urban water strategists to help formulate the objectives of the necessary institutional capacity building interventions for advancing SUWM. The 12 barrier types also provide cues for the integrated design of a sophisticated capacity building programme. While it is beyond the scope of this paper to lay out a prescription for institutional capacity building programme design to address the typology of barriers identified, some brief commentary is offered here on three key areas which should be integral to any sophisticated programme of change.

The first area should focus on fostering social capital for SUWM with the specific objective of improving the communities' technical and political capacity to equitably participate in SUWM decision-making. This is an important step for also engendering improved political will, and, in particular, organisational commitment. Considering that a significant proportion of SUWM practice occurs at the local level, local community capacity building could also provide an important pathway for developing a long-term vision. The second area should focus on inter-sectoral professional development with a focus on not only improving technical and knowledge competence, but also improving the institutional and political knowledge of professionals so they understand the broader operating environment that constrains and enables their day-to-day operating contexts. This can also enhance organisational commitment through improving staff energy and action, as well as providing a level of professional capacity to address technocratic path dependency. The third area should focus on sufficiently resourcing inter-organisational coordination programmes with an explicit objective of enabling institutional learning and new operation forums across sectors, organisations and departmental areas. The implementation of such programmes should hopefully reveal current administrative inconsistencies, conflicts and how the current regulatory framework could be improved. Having an integrated programme that includes these three areas can assist in developing: a long-term vision; statement of key community values; and therefore the establishment of indicators and targets for monitoring and evaluation.

CONCLUSION

While some positive advances have been made in working towards sustainable urban water management, particularly in regard to technological advancement, Mitchell (2006) points out, 'we still have a long way to go before [SUWM] could be considered as mainstream practice in the water and development industries'. Following a thorough review of available literature on institutional barriers to advancing SUWM, a typology of barriers was systematically identified and evaluated against a framework for identifying institutional capacity building needs. From the barrier types identified, it is clear the majority are predominantly institutionally embedded, systemic, relating to inter-organisational capacity and external rules and incentives, and are socio-institutional rather than technical. Further, many papers did not provide solutions with sufficient prescription to overcome the numerous institutional barriers. Therefore, it is expected that this typology may assist urban water policy strategists in developing more sophisticated

programmes of change in working towards advancing the implementation of SUWM practices and overcoming these barriers.

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