Towards Water Sensitive Cities in Asia: An Interdisciplinary Journey

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Abstract: Rapid urbanisation and the effects of climate change drive the need for sustainable urban water management (SUWM) in Asian cities. The complexity of this challenge calls for the integration of knowledge from different disciplines and collaborative approaches. This paper identifies key issues and sets the stage for interdisciplinary research on SUWM in Asia. It proposes a research framework to guide the process of interdisciplinary research in urban water management. Three key approaches are identified: (1) Governance and Society, (2) Technology Innovation, and (3) Urban Planning and Design.

Keywords: sustainable urban water management, Asia, interdisciplinary, water sensitive city

Introduction

Rapid urbanisation as a worldwide phenomenon is most prominent in Asia. Accounting for 65% of global urban expansion since the start of the century, the 21st century is shaping up to be the “Asian Urban Century” (UN-HABITAT, 2013). This transformation puts tremendous pressure on urban water systems, which is further aggravated by the effects of global climate change. Many Asian cities are ill-equipped to respond to the pressures (UNW-DPAC, 2010), as they face a host of social, institutional, technological and economic barriers to establishing ‘Sustainable Urban Water Management’ (SUWM) practices.

SUWM is advocated by an increasing number of scholars as an alternative paradigm to traditional water infrastructure and approaches, which can address the complex challenges facing urban water management (e.g. Brown, 2008; Brown et al., 2009; Pahl-Wostl et al., 2008). SUWM is an umbrella concept which encapsulates the concepts of Integrated Urban Water Management’ (IUWM) and ‘Water Sensitive Urban Design’ (WSUD) (Brown et al., 2009; Mitchell, 2006; Wong, 2006). Wong and Brown (2009) envisage a ‘Water Sensitive City’ (WSC) to be an ideal water state, embodying the principles and desirable practices of SUWM. A WSC integrates normative values of environmental protection, rehabilitation and sustainability with supply security, flood control, public health, amenity and resilience of cities to climate change (Brown et al., 2009; Wong and Brown, 2009). In addition, it has acquired diverse, adaptive, multi-functional technologies and infrastructure, with urban design features that reinforce water sensitive behaviours and practices, underpinned by a flexible institutional regime (Brown et al., 2009). In order for a city to initiate a transition towards a water sensitive state, it must embrace the principles and adopt the practices of SUWM (Brown, 2008; Brown et al., 2009; Wong and Brown, 2009). Brown et al. (2009) show how a WSC state can theoretically be achieved, in part, through cumulative change in socio-political drivers and service delivery functions that fully operationalise the principles of SUWM. Figure 1 shows the Urban Water Transitions Framework (UWTF) which can be used to demonstrate the continuum ‘states’ a city may pass through towards a WSC state. Each state represents a distinct shift in cognitive, normative and regulative 'pillars' of institutional practice (Brown et al., 2009).

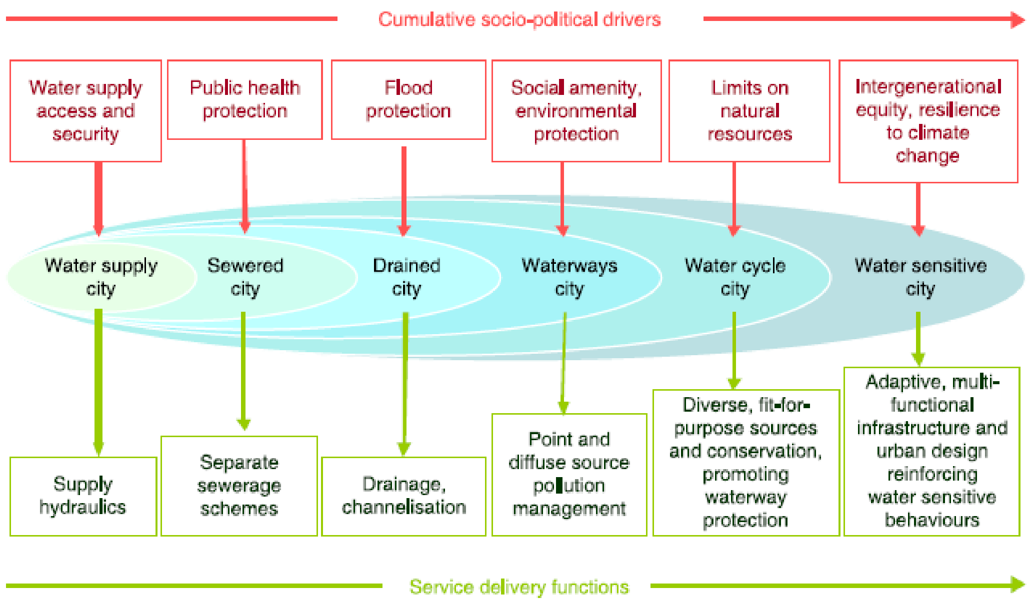

Figure 1: Urban Water Transitions Framework (Source: Brown et al., 2009)

An emerging line of inquiry in urban water transitions research is whether developing countries may be able to 'leapfrog' traditional urban water management and directly implement SUWM (Binz et al., 2012). Unlike cities in developed countries that are typically locked in to 'end-of-pipe' incremental change pathways associated with traditional urban water management, cities in developing countries have minimal lock in to such change trajectories (Perkins 2003; Binz et al., 2012), which theoretically presents developing cities with opportunity to 'leapfrog' towards a WSC state.

The United Nations (UN) recently released 17 'Sustainable Development Goals' (SDGs), of which Goal 6 – Clean water and sanitation, Goal 9 – Industry, innovation and infrastructure, and Goal 11 – Sustainable cities and communities, align closely with the concept of WSCs (UN, 2015). Each of these goals relates future prosperity to the provision of clean water, sanitation, community engagement, smart infrastructure and technological innovation. While these goals are specifically related, SUWM comprises a myriad of issues addressed by the other goals such as poverty, equity, protection of ecosystems and even ending hunger. Because of the complex interdependencies, uncertainty of future drivers and lack of consensus on solutions, the obstacles related to SUWM can be classified as 'wicked problems' (Rittel and Webber, 1973).

It is this 'wicked' nature of SUWM that calls for an interdisciplinary approach (Brown et al., 2015), as solutions from any one discipline are not fit to address this complexity. In this regard interdisciplinary is defined as researchers from different disciplines working together, but from their own discipline-specific base (Rosenfield, 1992), to address SUWM from both a biophysical and social perspective (Brown et al. 2015). Although complexity poses a challenge, there is also a range of opportunities to facilitate transformation and impact in this space. Our approach seeks to uncover and capitalise on these opportunities through interdisciplinary research that aims to bridge the interface between academic theory, policy-making and application.

Material and Methods

Traditionally urban water management solutions and innovations emerge from, and are sought after, within strictly separated disciplinary silos, most prominently social sciences and natural sciences/engineering. To have impact, an interdisciplinary approach requires breaking down the barriers between these silos. Therefore, rather than working within disciplinary silos, our research integrates the knowledge and expertise from both civil engineering and social science and engages with industry, governments and non-governmental organisations in the process. Collaboration is the key, both between academics from different disciplines and between academia, decision-making and implementation.

Brown et al. (2015) identify five fundamental principles for interdisciplinary research in SUWM: (1) a shared mission, (2) T-shaped researchers, (3) constructive dialogue, (4) institutional support and (5) bridging research, policy and practice. Following these principles, 13 researchers from five continents and diverse cultural backgrounds joined forces to tackle the full complexity of SUWM in Asian cities. While six of these researchers are based in the Department of Civil Engineering and seven from the School of Social Sciences; educational training and professional expertise ranged from civil engineering, environmental engineering, agricultural science, environmental science, sustainability, international relations, international development, economics, geography, resource management, psychology, religious studies and landscape architecture.

Results and Discussion

We developed a research framework that breaks down the disciplinary boundaries (see Figure 2). Three key 'angles' are identified to cover a broad spectrum of the issues identified when implementing SUWM in a developing Asian context. The framework serves as a heuristic model, and boundaries between the approaches are necessarily porous. As discussed below, these angles are: Governance and Society, Technology and Innovation, and Urban Planning and Design.

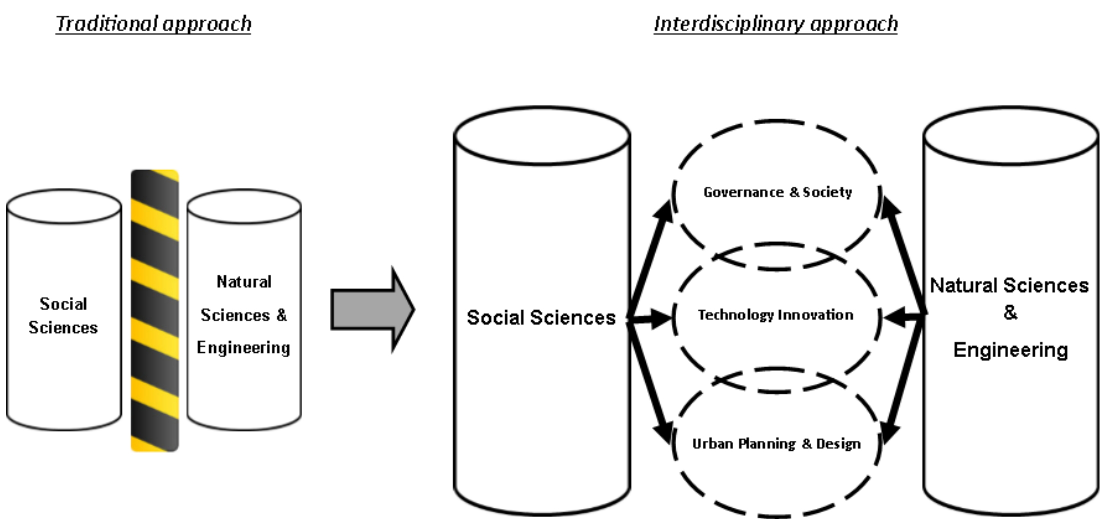

Figure 2: Research framework for interdisciplinary research to sustainable urban water management.

Governance and Society

To address the complexity of implementing SUWM in developing contexts, four key research topics are formulated through a governance and societal lens. We begin with a hypothesis that governance strategies are needed to facilitate progressive policies and institutional change for implementing SUWM in developing contexts. When faced with uncertainty and complex choices, conventional water institutions tend to go into inertia which sustains less-than effective governance structures and societal processes, such as organisational fragmentation, poor political processes, lack of accountability, bureaucratic complexity, ad-hoc decision making, entrenched inequality, and risk-averse attitude, amongst others. In contrast, studies have shown that new governance attributes (e.g. adaptive learning and experimentations, multi-stakeholder decision making, accountable and transparent process, just and equitable outcomes) need to be introduced in order to facilitate complex societal transformations as required by SUWM. Thus, we have identified the following research topics: (1) Identifying socio-political drivers and the enabling contexts for leapfrogging towards SUWM, (2) Diagnosing capacity for strategic action to accelerate SUWM adoption, (3) Assessing adaptive capacity to overcome institutional barriers for SUWM, and (4) Developing a justice framework to empower marginalised communities within SUWM. These topics are explored in three different contexts, Indonesia, Bangladesh and India (see Figure 3).

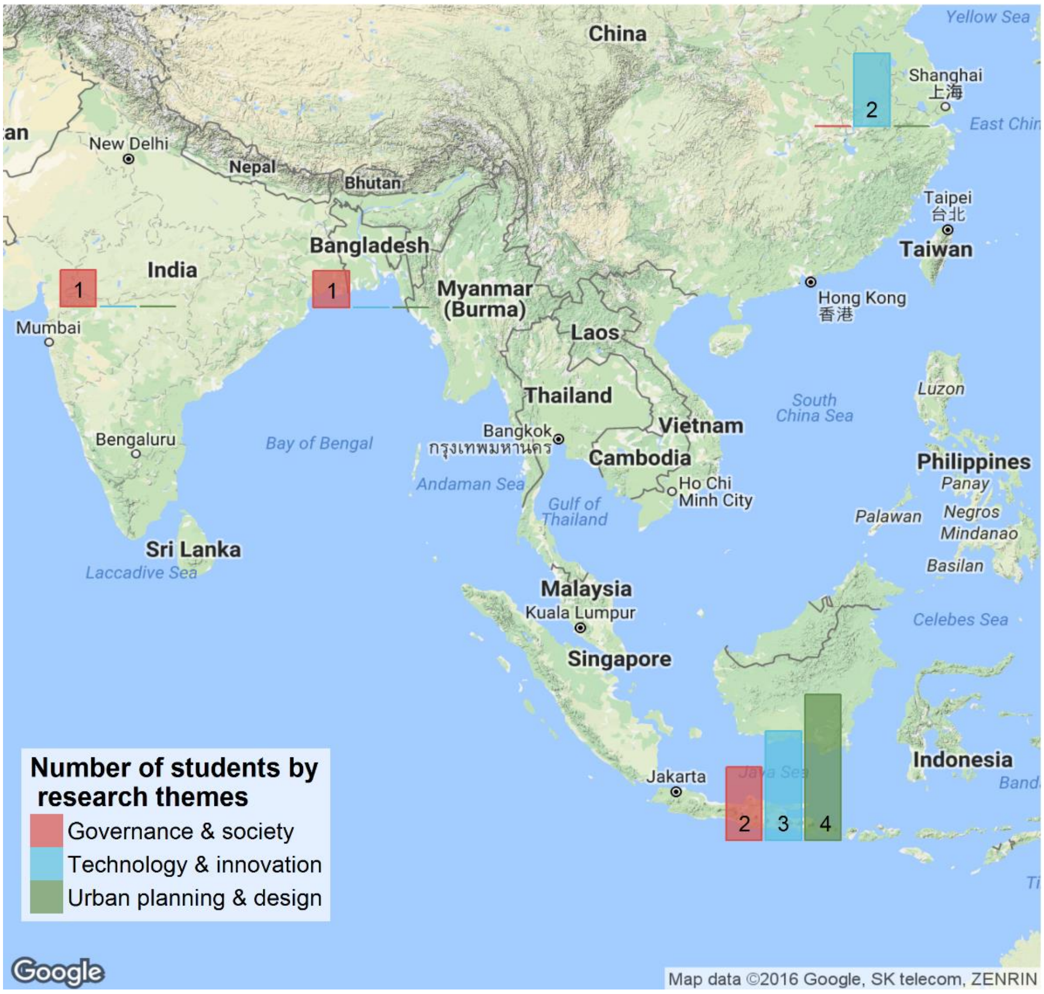

Figure 3: Map of SUWM research projects across Asia (Source: Google Base Map, 2016)

Technology Innovation

There are genuine opportunities for sustainable technologies to be adopted in many developing Asian cities, as urban water infrastructure has yet to be formalised. While centralised systems for water supply and wastewater treatment, along with large underground drainage networks for stormwater management were associated with a number of benefits (e.g. securing a clean water supply, improvements in health through the disposal of contaminated wastewater and mitigating flood impacts), they also come with a number of costs (Brown et al., 2009). These include but are not limited to; locked-in technology that is expensive to maintain, centralised systems that are difficult to upgrade, environmental degradation of local waterways due to discharging of polluted wastewater, impacts on the hydrological cycle and system vulnerability to climate change. Consequently, alternatives are being sought, including technology that is adaptable, multi-functional, cheaper and greener (Wong and Brown, 2009). As such, five projects are focused on the areas of; development of multi-purpose infrastructure and novel technologies for water treatment, emergence and uptake of innovations in sanitation, and international transfer of technology innovation. These topics are explored in two different contexts; Indonesia and China (see Figure 3).

Urban Planning and Design

Rigorous planning and functional design of the urban landscape are instrumental to facilitate growth and adapt to climate change. Planning and design are foundational to the physical exponent of the WSC. It requires deep understanding of the local spatial, demographic as well as social context. This understanding is combined with innovative green technologies called WSUD. WSUD includes systems such as raingardens, ponds and wetlands, which are aimed at stormwater retention, treatment and harvesting. Four researchers are included in this category. Research from this ‘angle’ includes the analysis of urban streetscapes, its drivers and dynamic changes over time. On a higher level, it concerns the spatial assessment of enabling and disabling locations, as well as spatially variable needs for WSUD. Furthermore, it includes the spatial simulation of the effects that different policy actions have. Finally, integrated modelling is performed to explore the interaction of all parts of the urban water cycle holistically. These topics are explored in Indonesia (see Figure 3).

Interconnections and Linkages

While each researcher sits within one of the above mentioned categories (or research angles) it is important to note that as a cohort we span the spectrum from pure engineering to social science research, with a number of researchers also working on individual interdisciplinary projects. Of the thirteen sub- projects, this roughly equates to: two pure engineering projects, one each from Technology and Innovation and Urban Planning and Design; four pure social science projects, two each from Governance and Society and Technology and Innovation; and seven interdisciplinary projects, two from Society and Governance, two from Technology and Innovation and three from Urban Planning and Design. Regular meetings, conversations and presentations are organised to facilitate dialogue and ideas amongst the group.

Interdisciplinary research: rewards and challenges

Interdisciplinary research has a more holistic view in solving complex problems in comparison to traditional silo research, however, it comes with both rewards and challenges. The biggest challenge we have found to date, is that it is hard and tiring.

Doing interdisciplinary research requires more time, more patience, more effort, more support and more money, than traditional projects we have worked on. The biggest incentive of interdisciplinary research is that by approaching problems from different angels and thinking about them through different disciplines can result in better ideas and new solutions. Besides this advantage, the process of doing interdisciplinary research has several personal rewards. In the journey so far, it has provided a good opportunity for individual researchers to gain or improve communication and team work skills. It has also enabled and facilitated learning about other disciplines. Through the increased communication with other each other, we have learnt to understand the dialogue of other disciplines; conversing across academic boundaries and beginning to speak a common language. With time this should lead to T-shaped professionals who can quickly collaborate across different disciplines; with new teams on future projects (Brown et al, 2015).

Conclusions

Complex challenges are facing urban water management in developing cities, such as; rapid urbanisation, population growth and climate change. However, there are also substantive opportunities to promote SUWM in this context, with urban water systems yet to be formalised and minimal lock-in to conventional approaches. Utilising an interdisciplinary approach and bridging the interface between the biophysical and social science disciplines, 13 researchers are working together to aid 'leapfrogging' of Asian cities to WSC futures. Three key approaches have been identified in this process; (1) Governance and Society, (2) Technology Innovation, and (3) Urban Planning and Design. This outward looking, interdisciplinary research framework will guide the next three years of our research in an effort to transgress single-discipline solutions and contribute on-ground impact to SUWM practices in Asia.

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