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The role of adaptive governance in supporting sustainability transitions in the Global South: a case study of urban water in Bangladesh

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Abstract

Contemporary water governance is widely regarded as being ill-equipped to respond to the ongoing pressures of rapid urbanization, population growth and changing climates. This is particularly clear within Global South (GS) contexts, where many cities lack basic water and water-related services. Water governance is particularly complex in the growing megacities of the GS, in which these challenges are exacerbated. Against this backdrop, scholars have suggested alternative conceptualisations of governance that steer and guide the transition pathways to promote and deliver sustainable urban water systems. Adaptive governance is proposed as a suitable approach for fostering attributes and capacities within urban water systems necessary to underpin sustainable transformations. While the application of adaptive governance concepts to case studies has generated empirical insights related to system change within Global North (GN) contexts, there remains a lack of evidence on how these approaches are made operational within the diverse socio-political and institutional contexts of GS cities. This raises questions regarding the applicability of adaptive governance framings to support an urban water system's ability to transform toward sustainability within the emerging economies of GS nations. Moreover, there is limited empirical understanding of what evolutionary processes and strategies are necessary to construct such capacities and governance in GS. To provide such empirical evidence and insights, this thesis examines **the role of adaptive governance in supporting transitions towards sustainable urban water management (SUWM) in the GS**.

The research adopted an embedded, qualitative case-study research design, drawing on the context of Bangladesh's urban water sector. Primary data was collected through oral histories and semi-structured interviews and analysed to develop chronological narratives and thematic insights into Bangladesh's water governance regime. Secondary data included media coverage and a range of policy, strategy and organisational materials, the content of which was analysed to inform deep understanding of the water governance context. A pluralist research approach guided the overall data collection and analysis processes by drawing on theories from sustainable transition and adaptive governance scholarship. A meta-analysis of established literature on urban water in the GS was conducted to develop an adaptive capacity and attributes framework (ACA), based on GS case studies featuring adaptive governance principles.

This research led to the first comprehensive multi-scale assessment of the historic and contemporary development pathways of Bangladesh's urban water sector. The assessment identified five significant shifts in governance approaches that have evolved over time under three dominant socio-political contexts (i.e. British, Pakistan and Bangladesh), which have defined and shaped colonial and post-colonial water governance and sectoral development. It revealed that as Bangladesh's water governance regime evolved, it incorporated adaptive governance features such as long-term planning, joint

initiatives, participatory and integrated approaches, and co-management approaches. These have been critical for purposefully designing and planning future water and sanitation interventions. However, utilising the developed ACA framework, this research reveals that these governance approaches and their associated management tools do not necessarily provide the appropriate context for improving adaptive attributes and capacities to underpin a sustainable urban water future for Bangladesh, which is dependent on the emphasis for investment, policy focus, government priorities and practitioner capacities across Bangladeshi cities.

The thesis found that the historical privilege afforded to Dhaka's urban water system means it is more advanced compared to other Bangladeshi cities. However, as a large-scale urban system, Dhaka is currently experiencing 'lock-in' due to ongoing investments in large-scale infrastructure, inappropriate transfer of technology from GN contexts, bureaucratic complexity and a general resistance to change. This lock-in makes it difficult to transform conventional urban water systems into more sustainable operations. For the first time, this thesis has examined a secondary city in Bangladesh—Mymensingh— and found it to be more open and flexible than Dhaka. This insight led to the identification of key enabling factors that might support sustainable growth at a faster pace in secondary cities than the large-scale urban water systems of major cities. The secondary city context provided stakeholders with greater opportunity for applying new institutional structures, harnessing lessons from project experiences, tailoring developments for specific contexts, and utilising participatory governance approaches. Data from Mymensingh revealed a clearly different historical trajectory compared to Dhaka and other big cities of Bangladesh. Overall, key development projects within Mymensingh are promoting a shift within contemporary governance strategies and are delivering adaptive attributes and principles that can act as a stimulus for promoting transformative change for advancing SUWM. Moreover, this governance shift is contesting the traditional, centralised system approaches and reflects a degree of improved capacity at a local scale with regards to better community participation in decision-making and more financial autonomy for the municipalities. This is a promising enabling context that can improve adaptive attributes to underpin a shift toward SUWM.

Overall, the thesis reveals how adaptive governance attributes and principles can provide guidance for and foster practices associated with advancing SUWM in GS contexts. It further sheds light on the role of adaptive governance in improving capacities (i.e. institutional, organisation and individual actor) at different city-scales to influence the pathways to sustainable development. Developing these capacities to effectively guide sustainability transformational processes depends on key enablers such as multi-level and polycentric institutions, participatory approaches, networking and bridging organisations, leadership, and learning.

Publications during enrolment

Journal articles:

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Thesis including published works declaration

I hereby declare that this thesis contains no material which has been accepted for the award of any other degree or diploma at any university or equivalent institution and that, to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

This thesis includes two original papers published in peer reviewed journals. The core theme of the thesis is governance transition to support a shift to sustainable urban water system in a global South context. The ideas, development and writing up of all the papers in the thesis were the principal responsibility of myself, the candidate, working within the School of Social Sciences-Human Geography under the supervision of Associate Professor Megan Farrelly and Dr Briony Rogers.

In the case of the publications presented in chapter 2 and 4 my contribution involved the following:

Thesis Chapter	Publication Title	Status *(published, in press, accepted or returned for revision, submitted)*	Nature and % of student contribution	Co-author name(s) Nature and % of Co-author's contribution*	Co-author(s), Monash student Y/N*
2	*Adaptive governance: a catalyst for advancing sustainable urban transformation in the global South*	*Published*	*Formulation of the research problem, research design, data collection and analysis, interpretation of results, writing the paper (87%)*	1) *Megan A. Farrelly (10%)* 2) *Briony Rogers (3%)*	*No* *No*
4	Evolution of Water governance in Bangladesh: an urban perspective	*Published*	*Formulation of the research problem, research design, data collection and analysis, interpretation of results, writing the paper (90%)*	1) *Megan A. Farrelly (7%)* 2) *Briony Rogers (3%)*	*No* *No*

I have not renumbered sections of published papers in order to present the publications in their original format, in accordance with Monash University Faculty of Arts guidance for thesis including published works.

Student signature: ███████████   **Date:**   21 November 2019

The undersigned hereby certify that the above declaration correctly reflects the nature and extent of the student's and co-authors' contributions to this work. In instances where I am not the responsible author I have consulted with the responsible author to agree on the respective contributions of the authors.

Main Supervisor signature: ███████   **Date:**   21 November 2019

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ABBREVIATIONS AND ACRONYMS

ACA	Adaptive Capacity and Attribute
AG	Adaptive Governance
BBS	Bangladesh Bureau of Statistics
BDT	Bangladeshi Taka (local currency)
CBOs	Community Based Organisations
DPHE	Department of Public Health and Engineering
DWASA	Dhaka Water Supply and Sewerage Authority
GoB	Government of Bangladesh
GS	Global South
GN	Global North
GWP	Global Water Partnership
HSC	Hydro-social contract
IWRM	Integrated Water Resources Management
IDAs	International development Agencies
LGED	Local Government and Engineering Department
MLP	Multi-Level Perspective
MSDP	Mymensingh Strategic Development Plan
NGO	Non-Governmental Organization
OECD	Organisation for Economic Co-operation and Development
SDGs	Sustainable Development Goals
SMAs	Statistical Metropolitan Areas
SDP	Sectoral development Plan
ST	Sustainable Transition
SES	Socio-ecological system
STS	Socio-technical system
SUWM	Sustainable Urban Water Management
TLCC	Town Level Coordination Committee
UGIIP	Urban Governance and Infrastructure Improvement project
UWM	Urban Water Management
USD	US Dollar
WASA	Water Supply and Sewerage Authority
WARPO	Water Resource Planning Organisation
WLCC	Ward Level Coordination Committee

Chapter 1

Introduction

1.1 Research background

Megatrends such as demographic growth, urbanisation and climate induced extreme events are critical for economic, social and environmental wellbeing of people and yet pose a threat to sustainable development (UNDESA, 2019). Cities are projected to absorb future growth of the world's population, 70% by 2050 (UNDESA, 2018, UN, 2015), and it is estimated that more than half of the global population is currently residing in Asian cities (UNDESA, 2018). In cities, water has been the driving force of economic and social wellbeing, and thus, remains an important feature for the delivery of sustainable urban growth; however, this largely depends on how water is governed (Romano and Akhmouch, 2019). In particular, governing water has been critical in Asian and African cities of global South (GS),[1] where water-related services have by and large focused on agricultural development (e.g. to ensure food security and economic productivity) and protection from flooding events rather than a cities' ability to deliver basic urban water services (Biswas and Tortajada, 2010; Larsen, Hoffmann, Luthi, Truffer and Maurer, 2016). Indeed, many GS cities do not have sufficient (more often absent) sewerage systems and have limited space for toilets, resulting in untreated and partially treated sewage being discharged into storm-water drains, waterways or landfill, polluting disproportionately poor residential areas (WHO/UNICEF, 2017).

Yet, while technology and services exist that could be adopted, it is widely recognised that addressing pressing water challenges associated with delivery of safe, reliable and sustainable water supplies and sanitation systems are indeed a deficiency of governance (Larsen et al., 2016; OECD, 2011, 2015; Pahl-Wostl, 2017; Tortajada, 2008). The OECD reports (2011, 2015) further pointed out that 'often water crises are water governance crises: managing water risks of too much, too little, and too polluted water is all the more challenging if the roles and responsibilities are not clearly allocated, stakeholders are not engaged, information is not shared and the capacities are not adequate to anticipate and tackle the risks' (cited in Romano and Akhmouch, 2019, pp. 2). To address this water governance crisis, scholars along with development agencies are calling for a shift towards new approaches that can support a cities' ability and capacity to adapt to changing circumstances, while maintaining their critical role in economic social and environmental wellbeing (Larsen et al., 2016; Pahl-Wostl, 2017; Romano and Akhmouch, 2019, UNDESA, 2015).

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[1] Global south cities refers to the cities in developing and least developed countries, whereas global North cities refers to the cities in developed/industrialised countries, based on industrial status, the human development index (UN, 2015) and the world economic situation and prospect report (UNDESA, 2018).

The generally accepted urban water management (UWM) practices based on well-established socio-technical systems (STS)[2] are considered by scholars as incapable of addressing growing governance challenges (e.g. reducing inequality in service provision and ensuring ecological health) (Brown, 2008; Larsen et al., 2016; Milly, Betancourt, Falkenmark, Hirsch, Kundzewicz, Lettenmaier, and Stouffer, 2008; Pahl-Wostl, 2007). This conventional UWM practices well established in global North (GN) cities, further mirrored in GS, and have had varying degrees of success (Biswas, 2006; Larsen et al., 2016; Milley et. al 2008; Tortajada, 2008). The conventional UWM practices have shaped water systems to become centrally managed large-scale infrastructure (e.g. piped networks, drains) for supplying water and removing storm and wastewater by governments and/or private enterprises to deliver cost-effective services with minimal opportunity for change based on feedback or learning (Brown, Keath and Wong, 2009a; Brown and Wong, 2009; Marlow, Moglia, Cook, and Beale, 2013; Pahl-Wostl, 2007).

However, in regards to increasing governance challenges arising from the implication of the megatrends, these conventional UWM systems are referring by GN scholars as 'locked in' to a particular technological trajectory, given sunk-investment costs in existing infrastructure (Chocat, Ashley, Marsalek, Matos, Rauch, Schilling, Urbonas, 2007; Milly et al., 2008; Unruh 2000), resulting in a 'path dependency' and institutional inertia (Brown et al., 2009a). This 'lock in' also reflects the challenges associated with transforming long-held, traditional governance approaches to water systems, which are typically a result of insufficient institutional, organisational and individual capacity to engaging in new practices, among other factors (Brown, Ashley and Farrelly, 2011; Brown, Farrelly and Keath, 2009b; Van de Meene, Brown and Farrelly, 2010). This capacity gap (both institutional and actor-oriented) suggests adopting alternative and radical sustainable solutions is more complicated than directly applying a new technology or approach in the water sector (Berkhout, Verbong, Wieczorek, Raven, Lebel, and Bai, 2010; Brown et al., 2009a; Farrelly and Brown, 2011; Pahl-Wostl, Lebel, Knieper and Nikitina, 2012; Van de Meene, Brown and Farrelly, 2011).

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[2] A socio-technical system refers to a system built around a dominant technology or technologies, the management and performance of which is fundamentally shaped by social and institutional dimensions (Smith and Sterling, 2010; van der Brugge and van Raak, 2007).

In this light, similar socio-institutional capacity barriers have been identified in these GS cities, as presented in Table 1.1. For instance, scholars have found that fragmented and isolated modes of operation by urban authorities are very common in these GS cities, which results in a lack of coordination, vague understanding of shared responsibilities, and a lack of skill in human resources (Briceno-Garmendia and Estache, 2004; Moinuddin, 2013; Mugabi, Kayaga and Njiru, 2007). Scholars also point out that these fragmented and isolated UWM strategies are largely operated by centralised control and require higher operational costs with little accountability (Briceno-Garmendia and Estache, 2004; Easterly and Serven, 2003; Moinuddin, 2013; Mugabi et al., 2007). Indeed, scholars identified that donors have influenced GS cities to adopt UWM strategies that might not be suitable for their context (Briceno-Garmendia and Estache, 2004; Easterly and Serven, 2003; Hurlbert and Gupta, 2015).

While many of these barriers to urban governance transformation have been repeatedly identified in the GN context (Brown et al., 2009a; Berkhout et al., 2010; Chocat et al., 2007; Farrelly and Brown, 2011; Milly et al., 2008; Pahl-Wostl et al., 2012; Unruh, 2000; Van de Meene et al., 2011), there is a dearth of academic scholarship analysing the underlying factors and potential to overcome these governance barriers in GS contexts, despite numerous calls from scholars (see e.g. Biswas and Tortajada, 2010; Mugabi et al., 2007; Pahl-Wostl, 2007).

Table 1.1: Socio-institutional barriers to transforming urban water governance

Issues	Barriers in GN cities	Barriers in GS cities
Operational authority	-Unclear, fragmented roles and responsibilities -Poor organisational commitment -Uncoordinated institutional framework -Limits of the regulatory framework (Brown, Sharp and Ashley, 2006; Marsalek, Rochfort and Savic 2001; McKay, 2005; Farrelly, Rijke and Brown, 2012)	-Fragmented and isolated mode of operation -Unclear roles and responsibilities of the authority concerned -Multiple service organisations with higher management costs -No coordination among different organisations -Lacks clear articulated vision (Briceno-Garmendia and Estache, 2004; Moinuddin et al., 2013; Mugabi et al., 2007)
Governance structure	-Limited community engagement, empowerment and participation -Poor communication -No long-term vision, strategy -Lack of political and public will (Brown et al., 2009a; Berkhout et al., 2010; Farrelly and Brown, 2011; Pahl-Wostl et al., 2012; Van de Meene et al., 2011).	-Lack of competent management structures and human resources -Donor influence and top-down approach in decision-making -Weak local government with limited functionality and capacity -Lack of political and public will and accountability (Briceno-Garmendia and Estache, 2004; Easterly and Serven, 2003; Moinuddin, 2013; Mugabi et al., 2007)

Economic efficiency	-Technocratic path dependencies -Insufficient resources (capital and human) (Brown et al., 2009b; Chocat et al., 2007; Milly et al., 2008; Unruh 2000)	-A higher investment but lower outcome due to the lack of governance -Lack of investment in infrastructure (ADB report, 2007; Bai, Wieczorek, Kaneko, Lisson and Contreras, 2009)
Learning capacity	-Lack of information, knowledge and understanding in applying integrated, adaptive forms of management -Little or no monitoring and evaluation (Berkhout et al., 2010; Farrelly and Brown, 2011; Pahl-Wostl et al., 2012; Van de Meene et al., 2011)	-Lack of proper learning dissemination mechanisms for adequate monitoring and evaluation of service status, which in turn leads to less effective service delivery. -Lack of diffusion of participation and information (Briceno-Garmendia and Estache, 2004; Easterly and Serven, 2003)

In response to the need for better management of urban water systems, including avoiding further lock-in and path dependencies, the concept of integrated water resources management (IWRM) has been adopted as an alternative and sustainable pathway (Agyenim and Gupta, 2012; Biswas, 2008; Global Water Partnership, 2000; Rouillard, Benson and Gain, 2014), and has become popular for GS countries (Agyenim and Gupta, 2012; Biswas, 2008). IWRM promotes strategies that integrate different parts of the water cycle and modern technologies for water management (Agyenim and Gupta, 2012; Biswas, 2008). For example, Bangladesh, India, and Indonesia have adopted the IWRM approach, which is now mainstreamed in different policies and strategic planning processes to improve their water management systems, including in urban areas (Benson, Gain and Rouillard, 2015; Koop and Van Leeuwen, 2015; Nastar, 2014; Rouillard et al., 2014; UN, 2014). IWRM implementation has, however, been less successful that anticipated, with scholars arguing it remains rooted in the conventional predict and control paradigm, despite its emphasis on integration and adaptive management principles (Biswas and Tortajada, 2010; Halbe, Pahl-Wostl, Sendzimir and Adamowski, 2013; OECD, 2015; Pahl-Wostl and Sendzimir, 2005; UNDESA, 2015).

Scholars explain that the reasons for the failure of operationalising IWRM approaches include vague understandings of the concept, a lack of guiding frameworks for implementation (Biswas and Tortajada, 2010; Koop and Leeuwen, 2015; Pahl-Wostl and Sendzimir, 2005), and a lack of policy experiments and learning approaches (Galaz, 2007). IWRM research, particularly in GS countries, has largely focused on how successful (or not) the application of IWRM has been (see e.g. Benson et al., 2015; Gain and Schwab, 2012; Rouillard et al., 2014), its relationship to transboundary water management (e.g. Ojendal, Hansson and Hellberg, 2012), and primarily on capital cities (Haq, 2006; Moinuddin, 2010; Nastar, 2014). There is limited empirical evidence of the capacity (i.e. institutions and actors) needed for implementing IWRM

approaches, which might deliver strategies to address the governance challenges in these GS contexts, and particularly their urban environments (Biswas and Tortajada, 2010; Koop and Leeuwen, 2015).

The sustainable urban water management (SUWM) concept has emerged, largely in the GN context in response to the call for alternative and sustainable pathways; however this approach also faces significant implementation barriers associated with conventional UWM systems (Brown 2008; Brown and Farrelly 2009). Yet in GS cities the concept is emergent and requires further experimentation in broader applications across different geographical regimes to determine effective approaches to water management practice (Halbe et al., 2013; Medema, McIntosh, and Jeffrey, 2008). Indeed, scholars have long called for relevant institutional and governance changes to advance SUWM implementation (Armitage, 2011; Poustie, Deletic, Brown, Wong, de Haan and Skinner, 2015; Starkl, Brunner, Lopez, and Martínez-Ruiz, 2013).

To date there has been limited relevant GS research on governance, water systems and transformation. Studies that have been done have highlighted, for example, the role of agency and institutions to accelerate sustainability transformation in an urban water system in Indonesia (Novalia, 2019); project-scale capacity developments for water supply services in Africa (Gumbo, Forster, and Arntzen, 2005; Hoko and Hertle, 2006; Wubneh, 2003); the potential benefits of decentralising urban water governance in Latin American mega-cities (Downs, 2001; Wilder and Romero Lankao, 2006); and finally, the role of legislative reform (Bakker, Kooy, Shofiani, and Martijn, 2008), tariff adjustment and privatisation in improving urban water service provision in South East Asia (see, e.g. Araral and Wang, 2013; Araral and Yu, 2013; Araral 2010; Araral, 2009).

However, despite this nascent body of academic work on institutional aspects of urban water supply management in GS countries, limited insights are available regarding the governance changes required for improving urban water management, particularly in emerging urban areas and their potential for alternative water development trajectories. Furthermore, in urban water governance literature there has been limited scholarly analysis or evidence related to the gaps arising and lessons learned from the multi-scale interactions inhibiting on-ground changes and the adaptive capacities (capacity of a system to adapt if the environment where the system exists is changing) required over time for transforming a system (see e.g. Biswas and Tortajada, 2010; Ferguson, Brown, and Deletic, 2013; Pahl-Wostl, 2008).

This thesis acknowledges urban scholars' call for attention to all social and political actors associated with urban service delivery that can meet the demands of citizens and enhance liveability without interfering with or damaging other people or the natural environment, now or in the future (Brockerhoff, 2000; Girerdat, 1999, Rana, 2008). This thesis explores the governance challenges associated with the delivery of urban water services, with a particular focus on capacity development for sustainable urban transformation. The Dublin conference (1992) emphases the important role of water governance and stated that 'water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels'. This was further reinforced through the Global Water Partnership (GWP) (2000), which stated that a water crisis is often a crisis of governance, and emphasised water-governance challenges requires critical attention.

The widely accepted definition of water governance is 'the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society' (GWP, 2002, pp. 14). Rogers and Hall (2003) elaborate upon this definition by highlighting the complexity of water management issues (complexity among relevant institutions, organisations and involved actors). The authors state that, 'Given the complexities of water use within society, developing, allocating and managing it equitably and efficiently and ensuring environmental sustainability requires that the disparate voices are heard and respected in decisions over common waters and use of scarce financial and human resources' (Rogers and Hall, 2003, pp. 16).

Further to understand on desired or future of water governance, Pahl-Wostl, (2015) defines 'Water governance is the social function that regulates development and management of water resources and provision of water services at different levels of society and guiding the resource towards a desirable state and away from an undesirable state' (p. 26). The author defines water management as distinct from water governance, which is 'the activities of analysing and monitoring, developing and implementing measures to keep the state of a resource within desirable bounds' (Pahl-Wostl, 2009, p. 355). Further to justify what 'desirable state' means in term of governance regime, scholars compares conventional and sustainable water governance regimes revealing important attributes to deal with modern sustainability challenges (figure 1.1). A water governance regime is also defined as 'an interdependent set of institutions (formal laws, societal norms or professional practices) which is the main structural component of a governance system' (Pahl-Wostl, 2015, p. 27).

To date scholars have characterised a sustainable water governance regime as having an adaptive and integrated service delivery approach, which some scholars argue involves adopting a 'soft path' (Gleick, 2003), 'management-as-learning' (Pahl-Wostl, 2007) and broader participation and flexible decision-making (Halbe et al., 2013); multi-scale characteristics and capacity to adapt to change (Ashley, Balmforth, Saul and Blanskby, 2005); multi-purpose thinking for healthy waterways and ecology (Brown et al., 2009a).
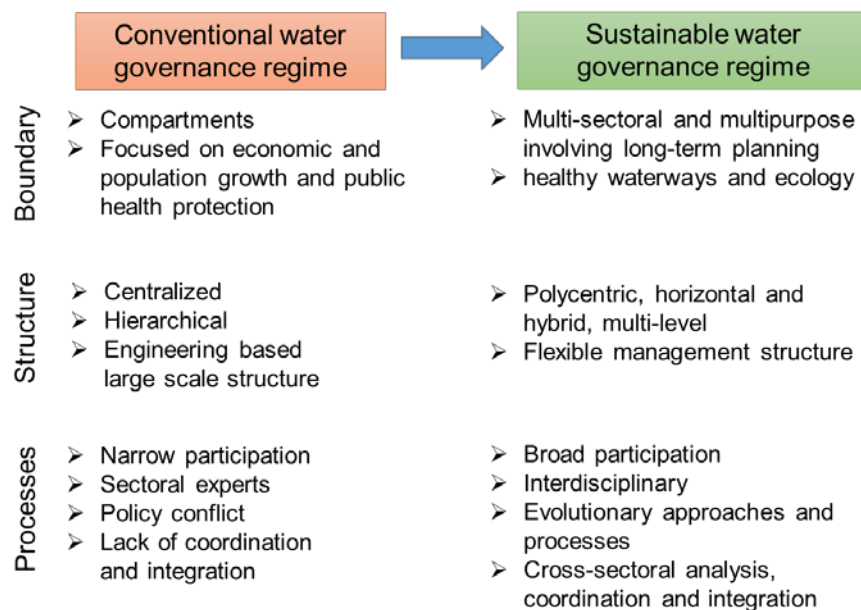
Figure 1.1 Conventional and sustainable water governance regimes (key attributes). Adapted from Ashley et al., 2005; Brown et al., 2009a; Keath and Brown, 2009; Pahl-Wostl, Holtz, Kastens and Knieper, 2010)

As this thesis focuses more specifically on water governance in an urban environment to address sustainability challenges. Therefore, drawing on the above-mentioned definitions and regime characteristics, this thesis defines urban water governance comprising institutions, organisations and stakeholders at multiple levels of implementation that offers strategies for managing, regulating and provisioning water services within an urban boundary. Further, for this thesis, sustainable urban water governance practices should reflect flexible, polycentric and inclusive characteristics for increasing necessary capacity of the involved institutions, organisations and actors.

To transform the conventional water governance regime to deliver sustainable governance strategies for advancing SUWM practices, scholars have long emphasised on the importance of adaptive and integrated management attribute as key to improve current UWM practices (see e.g. Kuzdas, Wiek, Warner, Vignola and Morataya, 2015; Loorbach and Rotmans, 2010; Pahl-Wostl, 2009). Despite this, there has been little guidance on how to achieve this, particularly in GS contexts. To understand such governance reforms, and in an effort to provide guidance for policymakers and practitioners, scholars have begun to look beyond single-theory approaches by drawing on other scholarly framings. Indeed, scholars have suggested theoretical cross-fertilisation (Wieczorek, 2017), theoretical multiplicity (Karpouzoglou, Dewulf and Clark, 2016) or a pluralist research approach (Biesbroek, Termeer, Klostermann, and Kabat, 2013). In essence, these and other scholars call for approaches that combine theories to address complex problems, and offer a means to explore enabling governance regimes to advance sustainable practices.

Adopting a pluralist research approach, two broad areas of scholarship have been identified as offering valuable insights for this thesis's research focus on capacities for governance transition: sustainability transitions (ST) and adaptive governance (AG). Across both these fields, scholars engage with enabling processes and adaptive capacities (formal/informal, intra- and inter-organisational) in social-institutional systems for encouraging transformations (Folke, Hahn, Olsson and Norberg, 2005; Loorbach and Rotmans, 2010; Pahl-Wostl, 2007). ST scholarship seeks to understand the transformation processes of socio-technical systems (STS), conceptualising the complex relations between technology and society (e.g. water systems, energy systems). ST offers insights that support decision-makers in orienting the transformation of infrastructures, institutions and practices to create more sustainable outcomes (e.g. Geels, 2002; Loorbach and Rotmans, 2010).

Complementing ST scholarship's focus on transformation, AG lies in the broader field of socio-ecological systems (SES), which examines the dynamics and governance of resource systems, with a focus on the interactions between nature and society. AG thinking emphasises improvements to the capacity of a system by promoting learning feedbacks from the processes of different management strategies that are already being implemented on the ground (Folke et al., 2005; Olsson Folke and Berkes, 2004). AG scholarship acknowledges the complexity of urban water systems and tries to address the challenges of water governance through participatory engagement with diverse actors (Birkmann, Garschagen, Kraas and Quang, 2010;

Farrelly et al., 2012; Pahl-Wostl, 2009). Nevertheless, critics have pointed out that effective operationalisation of AG for supporting sustainable transformation has largely focused on the GN context, whereas these concepts are still emerging in the GS (Geel, 2011; Karpouzoglou et al., 2016; Wiekzorek, 2017).

Indeed, scholars have noted that the foundational theories emerging from both areas of scholarship are grounded in empirical evidence from GN countries. To date, there is little understanding of the applicability of ST and AG approaches in the diverse socio-institutional and political contexts of the GS (Geel, 2011; Wiekzorek, 2017). While a limited number of studies examining GS countries are emerging (see e.g. Bakker and Kooy, 2007; Larson et al., 2013; Naster, 2014), these primarily focus on larger cities and there has been minimal research into how adaptive attributes and governance approaches are guiding sustainability transformations, either in capital cities or emerging secondary cities.

Thus, to transform urban water governance for advancing sustainable practices in GS further raises numerous questions including, among others, are these theories (AG/ST) sufficient for guiding a sustainable trajectory, in particularly for urban transformation in the GS context? Do GS countries have the capacity and technologies to make such advances? What strategies are necessary to support GS countries to implement such plans? Most importantly, can adaptive governance strategies and principles deliver the capacities and enabling contexts required for transition processes that would assist GS cities to progress faster towards sustainable practices and outcomes? Arising from these questions is the opportunity to build a greater understanding of how this pluralist research approach, drawing on both AG and ST scholarship, can be used to enable a sustainable governance approaches for the delivery of SUWM practices in GS contexts.

1.2 Research aim and objectives

The overarching aim of this research is to examine the role of adaptive governance in supporting a transition towards sustainable urban water management (SUWM) in global South cities. This will be achieved through an in-depth case study of a primary and a secondary city in Bangladesh and will explore the historical development of urban water practices, converging on contemporary water management in Bangladesh to identify opportunities to enhance urban water governance for transition to greater sustainability. The intention is to: i) advance urban

water governance research scholarship by obtaining insights into urban water transitions in the global South context; and ii) contribute insights for the Bangladesh context by identifying governance opportunities for advancing SUWM practices.

To achieve the overarching research aim the following three research objectives were selected:

Objective 1: *To identify the characteristics and attributes of adaptive governance underpinning sustainability transformations in the global South.*

This objective will be achieved through engaging with and extending the relevant academic literature through research questions such as: How have GS countries implemented AG principles and strategies? What are the key AG attributes and how have these attributes enabled or inhibited sustainable transformation in GS contexts? What constitutes an enabling context for the adoption of adaptive governance principles to support sustainability transformation?

Objective 2: *To characterise the evolution of adaptive capacities that underpin city-scale water governance practices in Bangladesh.*

This objective will be achieved by exploring Bangladesh's urban water system to unpack the characteristics of urban water governance regime transformation. More specifically, the thesis examines how these regime transformations have evolved over time, the critical AG attributes that have shaped the urban water governance regime and contemporary city-scale governance practices in Bangladesh, and how these are increasing the capacity of the urban water governance regime to support a shift to sustainability.

Objective 3: *To reveal how adaptive governance principles and practices facilitate sustainability transition in urban Bangladesh.*

This objective will be addressed by synthesising the insights from Objectives 1 and 2 to explain how adaptive governance principles and practices could facilitate the implementation of SUWM in Bangladesh and explore how this can be achieved in the context of other developing nations.

1.3 Research context

Scholarly evidence and policy rhetoric reveals that GS countries such as India, Bangladesh, Nepal and Indonesia are undergoing significant shifts in the water sector from 'business-as-usual' to adaptive and sustainable approaches, in particular in the policy realm (Bai et al., 2009; Rouillard et al., 2014; SDP-Water and sanitation 2010–2015). While Bangladeshi water managers have recognised that IWRM and climate adaptation strategies are necessary for urban water sustainability, there remain significant shortfalls in appropriate governance to support such transformation (Moinuddin, 2013). In the context of addressing water-related challenges, the Millennium Development Goals (MDGs) were the first attempt; however, some inherent capacity challenges (i.e. institutional and organisational) were never explicitly addressed.

For example, although Bangladesh demonstrated progress towards meeting the MDGs, any progress was impeded by pressing governance challenges in mobilising resources (MDGs-Bangladesh Country report, 2015). It has been acknowledged that while Bangladesh has made progress in policy, its translation to water systems remains limited (Benson et al., 2014). Indeed, the Sustainable Development Goals (SDGs) have begun to focus more explicitly on these capacity challenges in the context of governance and institutions. Therefore, research opportunities exist to explore these challenges in an attempt to identify key strategies for promoting a transformational pathway towards sustainability. Thus, we look to Bangladesh, a relatively young country, which has been demonstrably applying the MDGs and SDGs in an attempt to improve water practices.

This thesis examines Bangladesh's contemporary urban water governance regime to assess whether AG attributes are capable of underpinning sustainable urban water management. This is timely, due to the country's sustained and rapid urban population growth and the challenges associated with an agricultural focus on water resource management and a centralised push for more significant economic development. Such issues underline the vital role of sustainability in Bangladesh's development trajectory, and an increasing awareness of the need to improve local governance capacity (e.g. recent decentralisation of the administrative system) (Rana et al., 2011; Rouillard et al., 2014). In this context, there is a great scope to explore whether the insights and opportunities emerging from scholarly perspectives related to ST and AG are present.

There is evidence of AG principles being applied in GS contexts, including, for example: (i) climate change adaptation and disaster management (Bakkour, Enjolras, Thouret, Kast, Mei and Prihatminingtyas 2015; Butler, Suadnya, Puspadi, Sutaryono, Wise, Skewes, and Kisman, 2014; Hurlbert and Gupta, 2016); (ii) trans-boundary water resources governance (Akamani and Wilson, 2011); (iii) rural water management (Clark and Semmahasak, 2013; Kuzdas et al., 2015); (iv) groundwater and ecosystem services (Knüppe and Pahl-Wostl, 2013); and (v) IWRM (Rouillard et al., 2014). Yet there has been no explicit engagement with adaptive governance concepts in the domain of urban water management in the GS (Karpouzoglou et al., 2016). Therefore, contemporary governance reforms aimed at delivering change in developing cities lack a detailed understanding of the appropriate governance components that can improve sustainability transformation in urban water management.

1.4 Thesis structure

Following the research background and focus, aim and objectives, and thesis structure introduced in the present chapter, chapter 2 critically reviews the relevant literature in AG and ST scholarship and raises key questions by highlighting identified knowledge gaps. This entails focusing on key theories and concepts relevant to urban water management, with a particular emphasis on approaches for guiding sustainable transformation in the GS context. This in-depth literature review includes Publication 1, which was published in the International Journal of Water Resources Development. This publication outlines the critical attributes and enabling contexts for the GS and proposes a guiding framework to assist in identifying governance opportunities for sustainable urban water transformations in GS contexts.

The research methodology, outlining the research architecture and methods applied in data collection and analysis, explaining the research context and logic are presented in chapter 3. While this thesis is largely written as a traditional monograph, it includes publications, which means some parts of the methodology sections are repeated elsewhere. Chapter 4 presents an empirical analysis of the evolution of, and key shifts in, urban water governance in Bangladesh. It includes two sections. First, it discusses the evolution of governance change processes and charts 250 years of water resource development in Bangladesh. This section resulted in Publication 2, published in the journal World Development. Second, it analyses the evolution of governance change processes and assesses the level of adaptive capacity that underpins

sectoral development in Bangladesh's urban water system, with a focus on Dhaka, the capital city.

Chapter 5 examines Mymensingh, an emerging secondary city, as an example of a lower scale governance context. It analyses the contemporary multi-scale strategies adopted to improve local governance capacity. This investigation unpacks existing adaptive attributes and enabling context and guides the analysis of adaptive governance principles and practices in advancing sustainable urban water management in Bangladesh. Chapter 6 addresses the overall research aim by comparatively analysing the two case contexts presented in chapters 4 and 5. The chapter also highlights the benefits and tensions arising from the pluralist research approach, including the value of the guiding framework, by providing relevant empirical examples. Chapter 7 presents the conclusions of the thesis, including a synopsis of the research and a synthesis of the scholarly contributions the thesis makes in responding to identified gaps in the academic literature.

Table 1.2 presents the elements of the research designed to achieve the stated aim. This table also lists the publications included as a substantial part of the relevant thesis chapters.

Table 1.2: Relationships among the research objectives, questions, relevant chapters and publications in achieving the research aim.

Research objectives	Research questions	Chapters	Publications
1. **To identify the characteristics and attributes of adaptive governance underpinning sustainability transformations in the global South.**	*How have developing countries implemented adaptive governance principles and what relevant strategies have been adopted to support sustainable transformation?* *What constitutes an enabling context to support the adoption of adaptive governance principles for sustainability transformation?*	Chapter 2: Literature review	Publication 1: Adaptive Governance: A catalyst for advancing sustainable urban transformation in the developing context (published in the *International Journal of Water Resources Development*).
2. **To characterise the evolution of adaptive capacities that underpin city-scale water governance**	*What are the characteristics of the traditional urban water governance regime in*	Chapter 4: Urban Water governance in Bangladesh	Publication 2: Evolution of Water Governance in Bangladesh: an Urban Perspective

practices in Bangladesh.	*Bangladesh and how has this evolved over time?*		(published in *World Development*).
	What are the critical attributes of adaptive governance in the contemporary city-scale governance practices in Bangladesh? How are these shaping the contemporary governance regime towards sustainable transformation?	Chapter 4: Urban Water governance in Bangladesh Chapter 5: Water governance in a multi-level system: The case of an emerging city	
3. **To reveal how adaptive governance principles and practices facilitate sustainability transition in urban Bangladesh.**	*How do adaptive governance principles and practices facilitate the implementation of SUWM in Bangladesh and similar context of developing nations?*	Chapter 6: Adaptive governance for advancing sustainable urban water management in Bangladesh	

1.5 Summary

If the urban environments of GS cities, in particular water systems, are to be more sustainable, we need to engage with governance strategies suited towards building adaptive capacities to shape relevant sectoral development and to ascertain whether the existing capacity can support a sustainable transition or not. Overall, the scholarly field of AG and ST appear to provide some guidance on how to overcome the challenges associated with urban water system transformations in GS cities. To further explore this potential, the next chapter critically reviews the theories and concepts derived from AG and ST scholarship, identifies key literature gaps and discusses how these relate to the research aim and objectives.

Chapter 2

Literature Review

2.1 Introduction

Enabling a governance transition for advancing sustainable urban water management (SUWM) in global South (GS) countries requires changes in the domains of traditional governance and management practices (Armitage, 2011; Brockerhoff, 2000; Poustie et a., 2015; Rana, 2008; Starkl et al., 2013). To better understand how this could be achieved, this chapter reviews a number of core scholarly fields, key concepts and framing from sustainable transition (ST) and adaptive governance (AG). Recognising the diverse and complex challenges associated with delivering sustainable urban water systems, scholars promote the need for engaging with multiple disciplines and theories to understand the on-ground realities of water management practice and associated barriers to change (e.g. Karpouzoglou et al., 2016; Wieczorek, 2017).

Adopting a pluralist approach for this thesis further enables developing an understanding of different theoretical angles that enhance engagement and utilisation of insights, the reflexivity of the researcher's perspective and the impact of this perspective on research outcomes (see Biesbroek et al., 2013; Lewis and Kelemen, 2002). This approach has been adopted in many urban water studies and has generated a number of alternative frameworks aimed at advancing practices in urban water governance, including the 'fit-for-purpose' framework (Rijke, Brown, Zevenbergen, Ashley, Farrelly, Morison and van Herk, 2012), the management and transition framework (Pahl-Wostl, 2010) and the co-productive capacities framework (Wyborn, 2015). Based on the research objectives and questions formulated in chapter 1, this chapter draws on two different theoretical perspectives, ST and AG to provide different angles to understand and to further achieve the broader aim of this thesis, which are elaborated in the next sections.

2.2 Sustainability transitions research

Sustainable transitions (ST) scholarship focus on developing theories and the tools essential for understanding, managing and guiding change processes towards sustainability outcomes. ST scholars have sought to understand the complex interactions between the components of the socio-technical system (STS)[3] (e.g. Geels, 2002; Loorbach and Rotmans, 2010) and to offer insights that support decision-makers in orientating the transition processes within a system (e.g. water, energy) towards more sustainable outcomes.

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[3] The complex web of infrastructures and practices in a complex system gives rise to a 'strongly embedded and self-reinforcing system' and is referred to as a 'socio-technical system' (STS) (Smith and Stirling 2010, p. 13; see also chapter 1, p. 4).

ST literature is largely rooted in complex adaptive system theory (Holland, 1995; Kauffman, 1995), integrating concepts from governance (Sabatier and Jenkins-Smith, 1999), evolutionary economics (Arthur, 1988), innovation studies (Smits and Kuhlmann, 2004) and technological transitions (Geels, 2002). From a complex adaptive system perspective, transitions are system transformation processes in which the system undergoes irreversible reorganisation (Rotmans, Kemp, and Van Asselt, 2001). Transformations often involve long timeframes, with scholars suggesting large-scale sustainability transitions can take 25 to 50 years (de Haan and Rotmans, 2011), due to significant changes in and alignment across multiple domains, including technological, economic, institutional, political, behavioural and cultural ones; and across a number of scales, which collectively reinforce and drive the transition (Rotmans et al., 2001). Unpacking transformation processes at multiple scales of interaction provides narratives and critical agendas to influence future policies and strategic guidance (Frantzeskaki, Loorbach, and Meadowcroft, 2012, Nastar, 2014). Under the umbrella of ST, a number of different frameworks and tools have been developed, including the multi-level perspective (MLP) (Rip and Kemp, 1998), the multi-pattern approach (de Haan and Rogers, 2019; de Haan and Rotmans, 2011), transition management (Loorbach, 2007) and strategic niche management (Kemp et al., 1998).

The MLP framework has provided the basis for developing other frameworks and concepts and is popular for its conceptualisation of multi-scale interactions and change dynamics. The MLP offers a framework for analysing socio-technical systems' (e.g. urban water systems, energy systems) historical and contemporary development processes and pathways (Berkhout et al., 2010; Rip and Kemp, 1998; Rotmans et al., 2001). The MLP identifies three analytical scales (see Figure 2.1) that exist within a nested hierarchy, where the interplay across these levels works to reinforce and drive transition pathways (Berkhout et al., 2010; Rip and Kemp, 1998; Rotmans et al., 2001). The landscape scale encapsulates broader social values, political culture and economic trends that shape contemporary practices, and critical exogenous forces including, among others, climate change influences (Rotmans et al., 2001). Situated below landscapes are 'regimes' (Berkhout et al., 2010), which are conceptualised as patterns of institutions, and the physical and material infrastructures (such as water pipes, reservoirs, cognitive routines, actor networks, power relationships and regulations). Finally, niches are regarded as 'protected spaces', where individual actors, alternative technologies and local practices that deviate from 'business-as-usual' manifest as innovative ideas, initiatives, techniques or technologies (Kemp, Parto and Gibson, 2005).
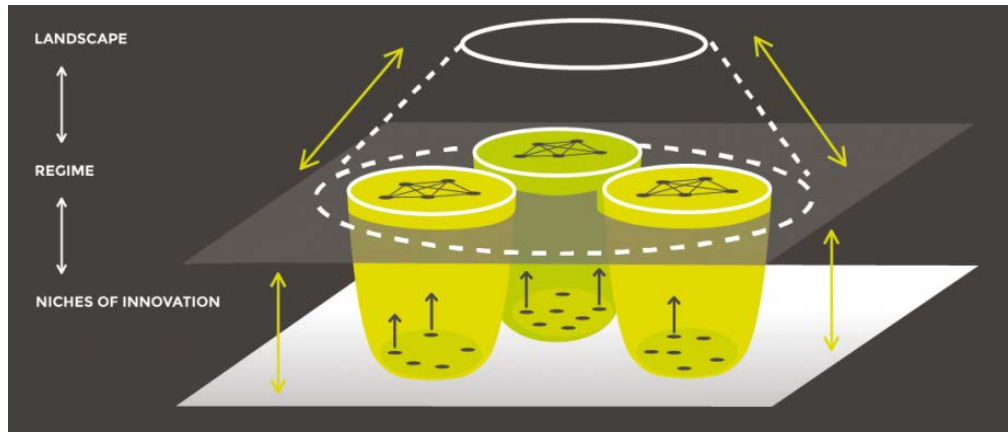
Figure 2.1 The multi-level perspective theory of sustainable transition (Geels., 2002)

Scholars have traditionally adopted the MLP to unpack the dynamics of historical sustainability transitions (Berkhout et al., 2010; Kemp et al., 2005; Turnheim and Geels, 2013). While MLP has been popular and widely used for analysing societal changes, including in the water sector, it has also been subject to several criticisms (Geels 2011; Lawhon and Murphy, 2012; Meadowcroft, 2011). It has been argued that the MLP is too mechanical to apply in a real-world situation in diverse contexts (Wieczorek, 2017); that it neglects the role of power, agency and politics in system transformation (Geels, 2011; Lawhon and Murphy, 2012; Smith, Stirling and Berkhout, 2005); and that it has blurry analytical levels (i.e. niche, regime, landscape) in which the MLP treats the regime as a homogenous entity rather than a complex mix of heterogeneous actors, structures and processes (Markard and Truffer, 2008). Nonetheless, its use as an analytical approach is recognised and valued for identifying and assessing the interplay across and in institutional and governance processes, practices and contexts (Berkhout et al., 2010; Nastar, 2014).

While the MLP offers a systemic and socio-technical perspective on change processes, its analysis does not necessitate a deep engagement with place-specific institutional contexts, nor does it focus on identifying core capacity attributes required to support regime transformation. ST scholars have also developed a number of action-oriented governance tools to facilitate change at different scales, for example: strategic niche management (SNM) (Geels and Schot, 2007; Raven and Geels, 2010) and transition management (TM) (Loorbach and Rotmans, 2010; Rotmans et al., 2001; Smith et al., 2005). SNM refers to a bottom-up perspective in the key interaction of niche innovations with prevailing regimes through the deliberate creation of

protected spaces to enable experimentation with new technologies (Raven and Geels, 2010; Schot and Geels, 2008). TM also refers to bottom-up initiatives, but focuses on their strategic use through the coordination of different levels of actors and nurtures self-organisation by innovative interaction and cycles of learning and action (Loorbach and Rotmans, 2006).

In contrast to SNM, the starting point in TM is a societal problem (i.e. delivering secure water supplies) (Loorbach and Rotmans, 2006). The TM approach has been critiqued for having a limited empirical research base (see Meadowcroft, 2005; Shove and Walker, 2007). SNM and TM focus on radical innovations, with an emphasis on learning, experiments and multiple actors' interactions at different scales, and therefore had some initial appeal and potential synergies with the present research. However, considering that the primary focus of SNM is understanding the dynamics and prospects of a particular complex problem around technological innovation to maximise the likelihood of widespread acceptance, it was considered less useful when examining the broader governance conditions for supporting change. Similarly, TM's focus on transition arenas as a governance intervention to orient or intervene in contemporary transformation processes meant it was considered less useful for this PhD research.

2.3 Sustainability transitions research in the global South

To date, the sustainability transitions scholarship has largely centred on understanding socio-technical trajectories in global North contexts, yet it also has significant appeal for analysing and guiding transitions in countries of the GS (Bai et al., 2009; Hansen, Nygaard, Romijn, Wieczorek, Kamp, and Klerkx, 2018). Given the cultural and structural diversity of GS, the pathways to sustainable trajectories are far more different compared to the GN (Lundvall, Vang, Joseph, and Chaminade, 2009; Bai et al., 2009). Thus, transferring theories and practices originating from the GN to this diverse GS empirical context is critical (Verbong and Geels, 2010, Hansen et al., 2018). Further to this space, Hansen and colleagues (2018) pointed out on different interpretation and context of key concepts, such as 'innovation'. They explains 'innovation' in GS is often 'less formalised' and further utilizes 'local assets and involve indigenous knowledge systems located outside R&D laboratories' (pp. 199). The concept of landscape-regime-niche also depicted in GS context more often as features at global-national-subnational/local levels (Hansen and Nygaard, 2014).

The applicability of a number of key concepts and theoretical framing (e.g. MLP, TM, and SNM) in GS contexts are found useful analysing the interplay of factors that motivate or hinder transitions to sustainability in this context (Hansen et al., 2018; Wieczorek, 2017). In particular, Wieczorek (2017, p. 7) highlights the challenges GS cities face, given the inherent differences associated with 'the timing, severity, complexity and multiplicity of the problems are nowhere near the scale of developments experienced by the Western world'. Her study reveals that in GS contexts path-dependency is present; the lack of or dysfunction in regime systems impedes transformation; and understanding the place-based institutional context is critical and often very different to conventional GN understandings (Wieczorek, 2017). This further confirms by Hansen et al., (2018) and proposes avenues for future research to be able to engage with empirical underpinnings to enrich the fundamental concepts of ST to guide the sustainable trajectory development.

ST literature in the GS context further sheds lights on key issues those critical and more often found contrary to GN perspective. In respect to regime stability and uniformity, GN scholars suggests that less stable and uniform governance regimes in GS resulted from lower political and economic standard with inefficient government could favour niche emergence in this context. GS scholar on contrary to expectation, further informs that such instable and varied governance regime is often becomes barrier for niche development (Hansen et al., 2018; Wieczorek, 2017). Furthermore, niches in GS often emerge and developed as single experiments driven towards achieving global indicators rather than extending to mature and provide platform for other innovations to occur (Kamp and Vanheule, 2015). More often niche experiments in GS failed or provides limited outcome without external support (e.g. donor investment) (Sengers, Wieczorek, and Raven, 2016; van Weliw and Rommijin, 2018). This further indicates the transitional nature of GS innovation and experiments and their linkages to international flow of knowledge, directions and further transformation (see e.g. Manning and Reinecke, 2016; Nygaard and Bolwig, 2018; Sengers and Raven, 2015; Wieczorek, 2015; Verbong et al., 2010).

Further to this, transitional connectivity and guidance for context specific transfer of theorise and strategies, transition scholars argues that GS countries have better opportunities to leapfrog compare to the industrial nations of GN by adopting most sustainable forms of strategies to that avoid damages of surrounding environment (Binz, Truffer, Li, Shi, and Lu, 2012). However, this debate further lacks explanation from empirical examples (Rock, Murphy,

Rasiah, van Seters and Managi, 2009; Angel & Rock 2009). Although, Poustie, Frantzeskaki, and Brown (2016) explain this issue of environmental leapfrogging in context of small islands of South-west Pacific region by utilising a heuristic 'urban water transition framework' (originated from Brown et al., 2009). The heuristic developed following a historical and contemporary assessment of urban water management practices using MLP, focusing on the normative, cognitive and regulative elements of water management unpacks the implicit hydro-social contract (HSC) (see Lundqvist, Turton and Narain 2001; Brown et al., 2009a). The HSC is defined as the implicit understanding of management arrangements between Government and community, legitimised through a historical, unwritten contract, where governments, on behalf of its citizens, protected broader society from resource access conflict, in particular access to water (Brown et al., 2009a; Lundqvist et al., 2001). Poustie et al., 2016 emphasised on this HSC and further informs to reform this HSC by building capacity of the relevant actors/organisations. He that the nature of partnerships developed with international organisations, local front-runners' capacity and contextual translation of strategies is critical for reforming HSC and further to support leapfrogging of GS cities. Poustie et al., (2016) further explains this capacity by using the lens of regime capacity framework informed by Van de Meene (2010) which shows capacity at four different spheres (e.g. individual/intre-& inter-organisational/administrative and regulatory).

Further, to transfer ST theories to GS contexts, Geels (2011) indicated that it is required to better understand the social, economic, institutional, political and historical contexts of these GS countries, in which the transition concepts of niches, regimes, landscape and stability are reframed as empirical questions rather than assumptions. Among the key ST frameworks, the MLP in particular has proven useful in historical studies in the GS context to examine change over time (Berkhout et al., 2010; Pant, Adhikari and Bhattarai, 2015). This thesis therefore, will utilise the MLP and focuses on associated empirical questions to unpack the structures and processes that underpin Bangladesh's urban water transitions. Notwithstanding the critiques of the MLP identified above, it will be useful for transforming empirical data into perceptions and for assessing the willingness and ability of institutions in developing contexts to implement the principles and practices of SUWM. Further, the MLP framework is flexible, meaning it can be easily combined with theories or concept (here adaptive governance) from other disciplines as part of this thesis' pluralist approach, and to unpack the interactions among critical components of the water governance system (Geel, 2010; Nastar, 2014).

Given ST broadly, and the MLP in particular are considers insufficient to provide theoretical insight into the governance attributes needed to transform urban water regimes, this thesis looks to another theoretical field: adaptive governance (AG).

2.4 Adaptive governance: Key concepts and attributes

AG emerged from the broader concept of environmental governance, offering insights for managing socio-ecological systems (SES) (Folke et al., 2005; Foxon, Reed and Stringer, 2009) and the potential for enabling conditions to deliver sustainable resource governance practices (see Birkmann et al., 2010; Folke et al., 2005; Gunderson and Light, 2006; Pahl-Wostl, 2009). AG considers how different social structures and processes link individuals, organisations, agencies and institutions at multiple organisational levels for managing the SES system (Folke et al., 2005; Gunderson and Light, 2006). Under the umbrella of AG are three core areas: i) adaptive management (Folke et al., 2005; Huitema, Mostert, Egas, Moellenkamp, Pahl-Wostl, and Yalcin, 2009); ii) adaptive co-management (Folk et al., 2005; Olsson et al., 2004), and iii) collaborative governance (Ansell and Gash, 2008; Bingham, 2011).

Adaptive management advances our understanding of specific interventions such as continuous learning processes to determine what has or has not worked in meeting economic needs and/or political goals, to ultimately inform when adaptation is necessary or to cope with uncertainty (Folke et al., 2005; Huitema et al., 2009). The concept of adaptive management was further enhanced to support improved coordination through feedback from learning experiences (Armitage, Marschke and Plummer, 2008; Ison, Blackmore and Iaquinto, 2013; Medema et al., 2008; Pahl-Wostl, Craps, Dewulf, Mostert, Tabara and Taillieu, 2007), flexible management structures (Ekstrom and Young, 2009; Huntjens, Lebel, Pahl-Wostl, Camkin, Schulze and Kranz, 2012; Pahl-Wostl et al., 2007), the formation of networks (Crona and Bodin, 2006; Nooteboom, 2007), building trust and social-capital tools (norms and culture) (Edelenbos et al., 2013; Folke et al., 2005), and participation and collaboration (Bakkour et al., 2015; Olsson et al., 2004).

Extending the management approach, adaptive co-management combines the concept of adaptive management with an explicit incorporation of cooperative approaches for managing local resources (Folk et al., 2005; Olsson et al., 2004). This approach recognises that management processes are dynamic, multilevel and polycentric, and seek a balance between

decentralised and centralised control (Folke et al. 2005; Olsson et al., 2004). Ansell and Gash (2008, p. 544) define collaborative governance as 'a governing arrangement where one or more public agencies directly engage non-state stakeholders in a collective decision-making process that is formal, consensus-oriented, and deliberative and that aims to make or implement public policy or manage public programs or assets'. Emerson and Gerlak (2014) identify four dimensions in collaborative governance that can support efforts to increase adaptive capacity: structural arrangements, leadership, knowledge and learning, and resources. However, collaborative governance is often criticised for its slow processes and can be seen as a poor option if a quick outcome is needed (Ansell and Gash, 2008; Imperial 2005; Warner 2006). For further discussion of these core concepts and their applicability, see the published journal article in the next section. Table 2.1 further represents a comparison of these concepts, including their core idea, emphasis and scope for the implementation of AG.

Table 2.1: Comparison of adaptive management, adaptive co-management and collaborative governance concepts (Adapted from Berkes, 2009 and incorporating Ansell and Gash, 2008; Pahl-Wostl, 2007; Plummer, 2009)

Themes	Adaptive management	Adaptive co-management	Collaborative governance
Concept	Learning by doing process	Joint management through learning by doing and exploration of polycentricism	Co-management of public policies and issues (common pool resources) through formal and collective decision-making processes
Designed to	Improve management policies and practices by learning from the outcomes of previously employed policies and practices	Enhance resilience and manage complex systems that transcend multiple levels and scales	Support state actors in formulating policy or to manage common pool resources with non-state actors through consensus building and minimising personal conflict
Emphasis on	Learning and experimentation through implementing monitoring and adjusting in real space and time	Joint management and learning by doing through local and scientific knowledge, sharing of rights, responsibilities and power by relevant stakeholders at multiple scales	Collective management and consensus-building, ensuring ownership, shared understanding and commitments, and power by relevant stakeholders at multiple scales
Linkage	Science and management for learning by doing	Horizontal and vertical for joint learning by doing	Multilateral (agencies and stakeholders) for managing common resources
Temporal scope	Medium to long term, multiple cycles of learning and adapting	Medium to long term, multiple cycles of learning and adapting	Medium to long term, multiple cycles of learning and adapting
Organisational level	Manager's needs and relationships	Multi-level, with self-organised networks	Multi-level, self-organised networks/ groups
Capacity-building focus	Resource managers and decision-makers	All stakeholders	All stakeholders

Although these AG approaches have attracted scientific and policy interest for more than a decade in relation to complex sustainability issues such as water, forest and river-basin management, there remains limited guidance on how to implement this approach to achieve sustainable development (Chaffin, Gosnell and Cosens, 2014), in particularly within the GS context. The GS context is highly diverse in relation to cultural and structural elements and less stable governance regime from lower political and governmental support. This in part speaks to the context-specific issues associated with this type of governance. Indeed, work by Rijke et al. (2012) attempted to capture the place-based (contextual) elements of governance by proposing a 'fit-for-purpose' governance framework. This concept emphasises that governance strategies are the result of different, multi-stakeholder interactions that reflect values, interests, knowledge and expectations. While useful, this concept still fails to detail how to implement AG at different governance levels (i.e. niche and regime level).

In an effort to understand to what extent AG capacities have been examined in GS contexts, the next section presents Publication 1, which critically analyses the contemporary application of AG in GS contexts and proposes a range of diverse socio-political and cultural enabling factors considered most capable of delivering opportunities for governance reform to support the implementation of SUWM.

2.5 Publication 1

Adaptive governance: A catalyst for advancing sustainable urban transformation in the global South
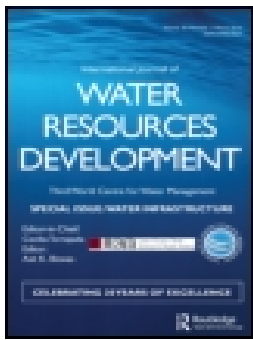
Adaptive governance: a catalyst for advancing sustainable urban transformation in the global South

T. Yasmin, M. Farrelly & B. C. Rogers

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Adaptive governance: a catalyst for advancing sustainable urban transformation in the global South

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ABSTRACT

Adaptive governance has been proposed by many scholars as an approach to sustainable resource management, and has subsequently been applied in many countries. While the conceptual origins of adaptive governance have largely emerged from the global North, there has been little critical attention to the utility of adaptive governance concepts in the global South. Through a qualitative meta-analysis of adaptive governance scholarship published between 2000 and 2018, this article characterizes the key attributes of adaptive governance in the global North and examines whether these attributes are present in contemporary scholarship on the global South. In doing so, the article confirms that adaptive governance principles are present, but reveals distinctions regarding how these manifest in the global South. The article proposes a guiding framework to advance the design and implementation of future adaptive governance interventions in the global South.

Introduction

Across the complementary scholarly fields of environmental governance and adaptive ecosystem management, adaptive governance (AG) has emerged as a normative, conceptual and analytical approach to address the inherent complexities of socio-ecological systems (SESs) to deliver improved natural resource management and achieve more sustainable development (Dietz, Ostrom, & Stern, 2003; Folke, 2006; Folke, Hahn, Olsson, & Norberg, 2005; Karpouzoglou, Dewulf, & Clark, 2016). AG, defined here as 'a range of interactions between actors, networks, organizations, and institutions emerging in pursuit of a desired state for social-ecological systems' (Chaffin, Gosnell, & Cosens, 2014, p. 1), appeals to many scholars and practitioners because the approach focuses on enabling processes such as participation and collaboration, working across scales, reflexivity, and the development of actor-networks (Folke et al., 2005; Pahl-Wostl, 2007).

Dietz et al. (2003), widely regarded has having first coined the term 'adaptive governance', proposed the first key attributes necessary for AG, including: analytic deliberation (e.g. inclusive dialogue between multiple resource users); institutional nesting (complex, redundant and layered); variety (e.g. network, hierarchical and

market-based structures); and designs that facilitate experimentation, learning and change. Extending this within the context of complex SESs, Folke and colleagues (Folke, 2006; Folke et al., 2002, 2004, 2005) revealed the importance of understanding ecosystem dynamics; developing integrated management practices that can interpret and respond to ecosystem feedbacks and continuously learn; building adaptive capacity to deal with uncertainty and surprise, including external drivers and supportive, flexible institutions; and establishing social networks in multilevel governance systems. These seminal studies prompted myriad empirical studies examining these 'adaptive' features in practice, to further identify attributes and dimensions associated with improving adaptive capacity and governance (Ansell & Gash, 2008; Armitage et al., 2009; Berkes, 2009; Brunner et al., 2005; Farrelly, Rijke, & Brown, 2012; Gupta et al., 2010; Huntjens et al., 2012; Pahl-Wostl, 2007; Plummer, 2009).

Nevertheless, critiques have pointed to the lack of insight regarding how to operationalize AG, leading to a broad range of associated scholarship including adaptive co-management (Olsson, Folke, & Berkes, 2004), co-learning processes (Armitage et al., 2009), collaborative governance (Ansell & Gash, 2008), multilevel learning frameworks (Pahl-Wostl, 2009), design principles for adaptive institutions (Huntjens et al., 2012), and 'fit-for-purpose' governance frameworks (Rijke et al., 2012), among others. This multiplicity of framings associated with AG is regarded as a key strength of the concept (Karpouzoglou et al., 2016).

In their recent scholarly review of the AG scholarship, Karpouzoglou and colleagues (2016) demonstrated that the body of knowledge has advanced rapidly since the early-mid 2000s, and expanded beyond theoretical conceptualizations towards an increasing number of empirical cases aimed at examining and identifying appropriate structures and processes for delivering improved management outcomes (see also Chaffin et al., 2014). Given that the foundations of adaptive management lie largely in broader SES thinking, it makes sense that many of the studies of AG align with critical resource management domains such as water, in both regional and urban domains (Clark & Semmahasak, 2013; Nastar, 2014), forestry and disaster risk management, alongside an increasing focus on the role of AG in delivering climate change adaptation (Bakkour et al., 2015; Mian, 2014; Nguyen, Miller, Bowen, & Tan Sinh, 2017; Panditharatne, 2016).

Similar academic reviews have also pointed to the scholarly foundations underpinning AG as being grounded in developed economies, and have highlighted that 'grey areas' remain in our understanding related to whether AG is an appropriate framing and/or approach for alternative socio-political and economic contexts (Chaffin et al., 2014; Clark & Semmahasak, 2013; Hurlbert and Gupta, 2016; Seeliger & Turok, 2014). Other academic reviews have pointed out that it might reflect the neoliberal agendas associated with North–South technology and practice transfers, with little or no consideration of the diverse socio-political and institutional contexts of countries in the global South (GS) (Hurlbert and Gupta, 2016).

Indeed, the majority of empirical cases published on AG have largely focused on experiences emerging from applications in the global North (GN), with limited examination of suitability in the GS. Few scholars have examined whether AG conceptualizations are appropriate in addressing the myriad challenges encountered in the rapidly transforming and heterogeneous GS. Indeed, Chaffin et al.'s (2014) review of a decade (2005–2014) of AG scholarship identified only nine papers explicitly examining AG situations in the GS. Thus,

further scholarly attention regarding how AG approaches have been catalysed, framed, adopted and operationalized (with reference to fostering adaptive capacities) across different socio-political, cultural and institutional contexts is warranted (Chaffin et al., 2014; Karpouzoglou et al., 2016; Pahl-Wostl, Lebel, Knieper, & Nikitina, 2012).

The applicability and utility of conventional AG approaches in diverse socio-political settings is a growing area of inquiry, with a rapidly growing number of peer-reviewed papers representing diverse country contexts and resource management domains (Evans, Brown, & Allison, 2011; Kuzdas, Wiek, Warner, Vignola, & Morataya, 2015; Nguyen et al., 2017; Rouillard, Benson, & Gain, 2014). This body of work presents an opportunity to critically review whether the original construction of AG is appropriate across diverse GS contexts and whether and how the concept is being adapted to suit different socio-political and institutional contexts. Responding to the call, the purpose of this article is twofold. First, the article seeks to establish whether the core framings and conceptualizations of AG are present in contemporary scholarship on the heterogeneous GS contexts. Here we examine whether these framings have been modified and/or whether similar adaptive capacities have been identified across the different socio-political and institutional settings. Second, the article aims to reveal patterns of convergence and divergence associated with governance contexts (e.g., structures, processes and opportunities) and the associated enabling attributes and capacities that may underpin a framework for diagnosing whether structures, processes and opportunities are delivering AG outcomes in diverse contexts. As cited in Chaffin et al. (2014), Brunner et al. (2005) suggest that AG cannot be condensed to a series of prescriptions; however, we seek to elucidate the 'patterns of practice' (Brunner et al., 2005, p. 19) and associated strategies emerging from a range of applications and thinking around AG in diverse socio-economic, political and institutional contexts, to inform future sustainable resource management transformation dynamics.

The article is structured as follows. The Research Approach section outlines the methods undertaken in the two phases of systematic scholarly review of empirical peer-reviewed journal articles. The next section describes the core conceptual underpinnings of the original framings of AG that have emerged from across largely Western, socio-political and institutional settings. Building on these insights, the following section reveals whether the core concepts and attributes have been identified and how they may have been adapted to suit the diverse socio-political contexts. Finally, critical insights are presented on the necessary enabling factors using a guiding framework for future AG interventions for the GS context.

Research approach

The research design mirrors recent approaches to examining AG scholarship by Chaffin et al. (2014), who focused on generating a chronological evolution of the theoretical and empirical AG scholarship, and Karpouzoglou et al. (2016), who examined the theoretical multiplicity associated with framing AG. This article extends these reviews by adopting a middle-ground, realist approach (Berrang-Ford, Pearce, & Ford, 2015). Here we use a systematic approach to collation of review articles, and adopt explanatory analyses to establish whether the foundational constituent elements of AG that emerged from largely stable, Western, developed economies are present in the growing body of
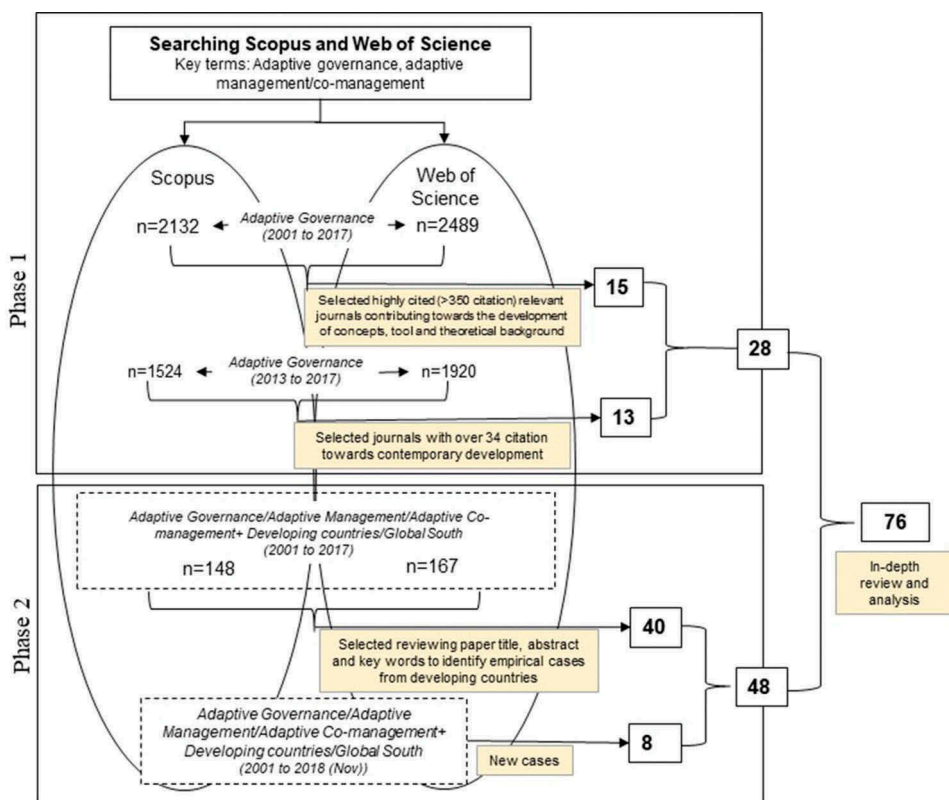
Figure 1. Schematic representation of systematic approach to identify journal articles for critical review. Note: Search items are shown in italic.

scholarship associated with AG in diverse socio-political and institutional contexts (e.g. GS contexts). This research was undertaken over two core phases (Figure 1).

Phase 1 was designed to identify the foundational concepts and framings in the AG scholarship. This involved searching two prominent web-based literature databases, Scopus and Web of Science, for peer-reviewed academic contributions focused on the terms 'adaptive governance', 'adaptive management' and 'adaptive co-management'. These terms are all deeply interconnected, as Dietz et al. (2003) recognize AG as the social context within which adaptive management occurs. The initial search (December 2017) resulted in a large number of articles (Scopus, 2132; Web of Science, 2489). To bound the number of papers reviewed, the authors focused on highly cited papers (over 350 citations) published since 2000, on the grounds that this demonstrated broad scholarly acknowledgement of core foundational papers and high-quality contributions to the AG scholarship. Each of these 15 papers was then analyzed to identify how the authors presented the theoretical and empirical backgrounds, and to identify the relevant concepts, tools and operational attributes associated with AG. These insights were then grouped into key themes to characterize the stated key elements in operationalizing AG.

Recognizing the selection criteria yielded papers that were confined to the 2000s, and to ensure that our review did not overlook contemporary insights (e.g. papers yet to be highly cited but representing important contributions to improving theoretical understanding of AG), a second web-based database search (with the same search words) was undertaken in December 2017, focused on articles published exclusively between 2012 and 2017. This yielded 1524 and 1920 publications from the Scopus and Web of Science databases, respectively. In line with the previous selection criteria, we limited our review to the 13 peer-reviewed papers that had achieved a citation rate of 34 or more. Notably, only one of these papers focused on AG experiences in a developing country. Collectively, these 28 papers provided the baseline for identifying and assessing whether these concepts, tools and attributes were reflected in AG studies in diverse socio-political and institutional contexts.

Phase 2 (December 2017) involved searching the same academic journal databases by combining the search strings 'adaptive governance', 'developing countries' and 'global South' and limiting the dates to between 2001 and 2017. The first search identified 148 and 167 journal articles in Scopus and Web of Science, respectively. Further refining this collection, we employed new search strings including the terms 'adaptive management' and 'adaptive co-management', as also done in Phase 1 (Figure 1). This resulted in 40 papers focused on AG in developing-country contexts. We then applied citation snowball sampling (Atkinson & Flint, 2001) to identify other key references that might have been overlooked. All the additional papers identified through snowball sampling were published within the last decade, but their citations were few, so they did not meet our selection criteria. We also excluded book chapters and short reviews, articles not associated with GS contexts and environmental governance, and articles that did not specify a particular country or region.

A second database search (November 2018) was undertaken to capture any new papers/insights that met the selection criteria. The same search terms were used, and eight more papers were identified (Figure 1). In total, 48 papers published between 2011 and 2018 were examined to understand the grounded realities of AG in GS contexts and across diverse socio-political and institutional settings.

The insights arising from Phase 1 were then used to frame the analysis of the 48 papers to establish whether these concepts and framings were present. This involved treating each paper individually and involved systematically examining its scope and/or specific objectives; case location; first author's affiliation (to gain insight into their scholarly lens); definition and key concepts of AG used; key contributions and highlighted elements of AG; and identified research gaps.

Across the 48 papers, the search yielded empirical studies from 20 distinct GS contexts. To elucidate patterns of convergence and divergence, we grouped the papers into four regions, following the United Nations categorization of countries based on industrial status and human development index (UN, 2015) and in the *World economic situation and prospects report* (UN, 2018): southern Asia, South-Eastern Asia, sub-Saharan Africa, and Latin America and the Caribbean (Table 1). While the review acknowledges the heterogeneous characteristics across these regions (e.g. they are diverse in culture, socio-political structures, and natural resources), the regionalized approach afforded the opportunity to examine similarities and/or differences in resource management across the regions. Where relevant, we have highlighted key points of divergence within the regions.

Table 1. Regional categorization of the reviewed case countries.

Region	Southern Asia	South-Eastern Asia	Sub-Saharan Africa	Latin America And Caribbean
Countries	Bangladesh (LDC) (1–4) Sri Lanka* (5) India* (6–9, 14) Nepal (LDC) (10–12, 15, 16) Pakistan (LDC) (13) (LDC: least developed country; *developing country)	Indonesia * (17–20, 26) Thailand * (21–22) Vietnam * (23–25)	Kenya * (29, 30) Mozambique (LDC) (27) South Africa *(27, 31) Namibia * (28) Angola * (31)	Argentina* (34) Chile* (34) Bolivia (35) Costa Rica*(32–33) Mexico* (36) Guyana** (37) Honduras** (37) (**small island developing state)
Research Domains	-Water resource management (water governance, Integrated Water Resources Management, urban water governance) -Forest conservation and co-management -Climate change adaptation -Agricultural sustainability -Disaster Management	-Water resources management (urban water management) -Climate change adaptation -Disaster management -Environmental management, water -Forest conservation	Coastal resourse management and governance	-Disaster management -Agro-ecology -Water governance -Climate change adaptation -Natural resource management -Coastal resource management
References	1. Benson et al., 2015; 2. Rouillard et al., 2014; 3. Ahammad et al., 2014; 4. Bahauddin et al., 2014; 5. Panditharatne, 2016; 6. Azhoni et al., 2016; 7. Nastar, 2014; 8. Srinivasan et al., 2013; 9. Srinivasan, 2015; 10. Biggs, Duncan, Atkinson, & Dash, 2013; 11. Regmi et al., 2016;12. Pant, 2016; 13. Mian, 2014 14. Walch, 2019; 15. Shrestha, 2013; 16; Ranabhat, Ghate, Bhatta, Agrawal, & Tankha, 2018; 17. Larson et al., 2013; 18. Butler et al., 2014; 19. Grady et al., 2016; 20. Bakkour et al., 2015; 21. Satumanatpan et al., 2014; 22. Clark & Semmahasak, 2013; 23. Nguyen et al., 2017; 24. Orchard et al., 2015; 25 Clemens, Rijke, Pathirana, Evers, & Hong Quan, 2016; 26. Yoseph-Paulus & Hindmarsh, 2018; 27. Celliers et al., 2013; 28. Falk et al., 2009; 29. Evans et al., 2011; 30. Cinner et al., 2012; 31. Sowman & Raemaekers, 2018; 32. Cinner et al., 2012; 33. Kuzdas et al., 2015; 34. Hurlbert & Gupta, 2017; 35. Winkel et al., 2016; 36. Vargas et al., 2017; 37. Mistry et al., 2011; 38. Bown, Gray, & Stead, 2013.			

Adaptive governance: key framings and core attributes

Under the umbrella of environmental governance, the concept of AG is typically framed as a critical context for guiding and enabling 'adaptive' processes (e.g. promoting learning and emergent management strategies) to promote transformations (Folke et al., 2005; Olsson et al., 2004; Pahl-Wostl, 2007). Similar to Karpouzoglou et al.'s (2016) review, AG has been largely framed as an approach to generating resilience within SESs and can result in better management of SESs (Adger, 2006; Folke et al., 2005; Walker, Holling, Carpenter, & Kinzig, 2004). Case-driven articles have sought to determine specific conditionalities for this to become realized, and most of the highly cited papers centre around the importance of appropriate structures and processes for managing SESs, for example

- multi-actor platforms (e.g. experiments and networks) and multilevel (social) learning (e.g. triple-loop learning, knowledge sharing – Armitage et al., 2009; Berkes, 2009; Pahl-Wostl, 2009; Pahl-Wostl, 2007);
- institutional arrangements such as networks and polycentricism (e.g. Cinner et al., 2012; Crona & Parker, 2012; Huntjens et al., 2012); and
- informal dynamics and processes (e.g. self-organization, shadow networks, leadership – Berkes & Ross, 2013; Olsson et al., 2004; Pahl-Wostl, 2009).

Several scholars have designed and explored different appropriate structures and processes for managing SESs, largely under three key approaches: adaptive management (Folke et al., 2005; Pahl-Wostl, 2007), adaptive co-management (Berkes, 2009; Plummer, 2009; Plummer, Armitage, & De Loë, 2013), and collaborative governance (Ansell & Gash, 2008). The 13 contemporary papers revealed a shift away from the overarching positioning of resilience (though it was still present in three papers) towards examining operational features in more empirical detail, and an engagement with complementary research domains, including psychology (Berkes & Ross, 2013), management science and education (Cundill, Cumming, Biggs, & Fabricius, 2012), law (Cosens, 2013), and socio-technical system re-configuration (Rijke et al., 2012).

Overall, across the collated papers from Phase 1, key scholarly contributions revealed a suite of novel governance capacities that are required in a system or are in need of development, such as institutions, learning processes, capacity building and network activities, and stakeholder engagements which continuously nurture the development of adaptive capacities (Folke, 2006; Walker et al., 2004). Although questions remain regarding the effectiveness of these concepts for improving governance in practice, these framings provide insights regarding critical enabling factors to support a transformation. In particular, scholars emphasize the interactions, participation and collective decision-making of multiple actors facilitated through network-building, learning feedback loops, horizontal and vertical institutional arrangements, and a clear vision for achieving a sustainable outcome (Folke et al., 2005). Table 2 lists these critical attributes with enabling conditionalities to support transformation; those were considered a key point for further exploration of AG application in GS.

Table 2. Critical attributes and enablers for adaptive governance.

Governance context	Critical elements	Characteristics	Enabling conditions/ opportunities
Structure	Institutions	Flexibility Reflexivity Robustness	Multilevel and cross-scale interaction Inclusive decision making Bottom-up learning Polycentric institutions
Processes	Learning	Single loop, double loop and triple loop* Multilevel and cross-scale Social memory Innovation	Self-organization Trust building Experimentation Bridging organizations Collaboration Diverse actors and networks Short and long term impacts Communication Historical analysis
	Capacity building	Vision and agenda Policy Compliance Mobilization of resources (financial, human and natural resources) Problem framing and solutions Anticipation Room for choices and improvements	Multilevel and cross-scale linkages Decentralized systems Infrastructure, technology and funding Rules and regulations Leadership Learning Accountability Mobilization of funds and resources
	Stakeholders engagement	Participatory Collective and collaborative Diversity in actors and networks	Formal activities Informal activities Collective action and decision making Leadership Institutions

* See Pahl-Wostl et al. (2009) and Armitage et al. (2009) for definition and further explanation.
Refs: Folke, 2006; Folke et al., 2005, 2002; Olsson et al., 2004; Pahl-Wostl, 2007, 2009; Huntjens et al., 2012; Halbe, Pahl-Wostl, Sendzimir, & Adamowski, 2013; Rijke et al., 2012.

Adaptive governance insights emerging from diverse contexts

Across the 48 articles and four regions, the collated empirical studies covered five key domains, including 19 papers in water management (39.5%), seven in forest conservation (14.5%), six in agricultural sustainability (12.5%), seven in disaster management (14.5%) and 12 in climate change adaptation (25%). Only six of the 48 papers explicitly examined the urban context, regarding cities as complex systems, and identifying significant challenges related to rapid urban population growth and ensuring equitable access to resources. Across these six papers, the authors articulate a pressing (normative) need to shift away from current development trajectories, to deliver sustainable transformations guided by AG principles (Larson, Alexander, Djalante, & Kirono, 2013; Nastar, 2014; Srinivasan, Seto, Emerson, & Gorelick, 2013). Beyond urban complexity, the other 42 reviewed papers explored various resource contexts, including river basins and water management (Azhoni, Holman, & Jude, 2016; Sultana, Thompson, & Green, 2008), marine environments (Cinner et al., 2012; Evans et al., 2011), forestry (Ahammad, Hossain, & Husnain, 2014;

Ranabhat et al., 2018) and coastal management (Orchard, Stringer, & Quinn, 2015; Panditharatne, 2016; Satumanatpan, Senawongse, Thansuporn, & Kirkman, 2014).

The selected papers explored and addressed AG in various ways, but two key dominant outcomes were identified. In their contextual analysis of AG, management and/or capacity, many of the papers revealed key 'emerging' constituent elements as present and improving as a result of applying them on the ground. While the concept of AG itself is emerging and new to this GS context, there are several challenges indicated by the scholars as still needing critical attention. To minimize the challenges, scholars also suggested AG attributes that are necessary to improve adaptive capacity and sustainable resource system, labelled here as the proposed attributes. Table 3 reveals these key AG attributes (both emerging and proposed) as a response towards practising AG principles on the ground. Such insights may prove useful for governing future SESs' resilience and socio-technical transformations, by improving adaptive capacity.

Across the diverse regions, challenges within the institutions (structure and processes) were routinely identified as the most significant constraint in delivering effective governance. The empirical papers reveal popular strategies to address this challenge, including applying co-management strategies, as an alternative to state-led centralized resource management activities. The ideology of 'co-management' involves ensuring access to and control over resources by relevant stakeholders, where local actors can participate in decision-making processes and increase their adaptive capacity over time (Berkes & Ross, 2013; Plummer et al., 2013). Nevertheless, despite many efforts and empirical examples, the success of such approaches remains questionable (Ahammad et al., 2014; Bakkour et al., 2015). Indeed, the reviewed papers reveal that the socio-political and institutional arrangements of the diverse contexts are not conducive and typically fall short of implementing adaptive management and co-management strategies (Cinner et al., 2012).

Despite the limitations identified, there remains continuous rhetoric from scholars analyzing GS examples regarding the need for institutional changes to better accommodate such co-management strategies. Scholars argue that to effectively deliver on this management approach, first a deep exploration of formal and informal socio-political structures is necessary to determine avenues for effective adaptation strategies (Ahammad et al., 2014; Panditharatne, 2016; Regmi, Star, & Leal Filho, 2016). Scholars also emphasize identifying common mainstreaming strategies and interactive processes and platforms at different implementation scales to better shape knowledge construction, provide flexible management, and improve stakeholders' capacity to access and distribute financial and natural resources (Table 3) (Azhoni et al., 2016; Panditharatne, 2016; Regmi et al., 2016). The scholarship points to delivering flexible management and improving stakeholders' capacity, which is described as demand-driven planning (bottom-up approach) and continuous exploration and designing of management interventions through policy learning, to build trust among different stakeholders, assist in resolving conflicts, and encourage collaborative power-sharing (Bahauddin, Rahman, & Hasnine, 2016; Bakkour et al., 2015; Butler et al., 2014).

Across the regions and various socio-political contexts, the academic literature points to ongoing governance transitions in most countries, whereby polycentrism (largely framed through decentralization) has been adopted to improve institutional and management capacities (Celliers, Rosendo, Coetzee, & Daniels, 2013; Falk, Bock, & Kirk, 2009;

Table 3. Key adaptive attributes emerging from the diverse socio-political context of the global South.

Governance context	Adaptive attributes	Emerging attributes (EA) / proposed attributes (PA)	Southern Asia	South-Eastern Asia	Sub-Saharan Africa	Latin America and Caribbean
Structure	Co-management	EA	✓	✓	✓	✓
	Polycentric	EA and PA	✓	✓	✓	✓
	Multi-scalar and multi-level	EA +PA	✓	✓	✓	✓
	Networked (Formal and informal institutional interactions)	PA	✓	✓	✓	
Processes	Flexible, participatory and integrated	EA	✓	✓	✓	✓
	Stakeholders diversity	EA	✓	✓	✓	✓
	Adaptive decision making and accountability	EA	✓	✓	✓	✓
	Multi stakeholder approach (decision-making and implementation)	PA	✓	✓	✓	
	Knowledge construction (local and science-policy level)	EA	✓	✓		✓
	Learning cycle	EA	✓			
	Tailored made learning processes (feedback mechanism, inclusive to local knowledge)	PA	✓	✓	✓	✓
	Shared visioning	PA	✓	✓	✓	
	Mixed approach (i.e top down/demand driven bottom up strategies, integrated approach)	PA	✓	✓	✓	✓
Opportunities	Sensitized community	EA	✓	✓	✓	✓
	Resource distribution and access	EA	✓	✓	✓	✓
	Brokering/mediation/linkages	EA+PA	✓	✓		
	Political and local leadership	EA + PA	✓	✓ (i.e political and provincial leadership)	✓ (i.e political leadership)	✓ (collaborative and visionary leadership)
	culture of experimentation/context specific strategies	EA	✓	✓	✓	✓
	Policy and legislations	EA	✓	✓	✓	✓
	Development strategies (national and international led; avoiding institutional and ideological path dependencies)	PA	✓	✓	✓	✓
	Capacity and skill (in particular, the local actors in resource management)	PA	✓	✓	✓	✓
	Innovation and experimentation	PA	✓	✓		
	Tailored made training	PA	✓	✓	✓	

Srinivasan et al., 2013). Polycentrism involves multiple decision-making centres within a region, which in combination with decentralization is an attempt to distribute power and authority across a variety of implementation scales (Pahl-Wostl et al., 2012). While several researchers claim that this approach is more adaptive and strongly connected with good governance principles – engaging with diverse stakeholders, ensuring accountability, fair distribution of resources (Falk et al., 2009; Hurlbert & Gupta, 2017; Pahl-Wostl et al., 2012), scholars also note that this structural shift is largely promoted and driven by transnational donors who provide core guidance and financial support (Azhoni et al., 2016; Falk et al., 2009). Despite the growing emphasis on polycentrism, the scholarship has yet to generate empirical insights regarding *how successful* these approaches are. Indeed, the reviewed papers revealed significant institutional shortfalls and sectoral conflicts which constrain successful implementation of polycentric governance approaches, for example

- insufficient investment in and strategies for improving individual and organizational capacity and autonomy of local institutions for mobilizing resources and knowledge (Azhoni et al., 2016; Celliers et al., 2013; Falk et al., 2009);
- significant gaps associated with translating policy into action at different implementation scales – e.g. local, regional and national (Azhoni et al., 2016; Falk et al., 2009; Kuzdas et al., 2015);
- limited compliance with legislation, disconnected policies, gaps in communication and coordination, and inadequate resourcing (Falk et al., 2009; Grady, Gersonius, & Makarigakis, 2016);
- lack of necessary initiatives and incentives by the government to drive effective participation (Kuzdas et al., 2015; Panditharatne, 2016);
- lack of access to necessary information and data (Azhoni et al., 2016); and
- power struggles across relevant agencies (Azhoni et al., 2016; Bahauddin et al., 2016).

Future engagement and explorations with practising AG require attention to these issues for successful implementation. The scholars proposed some strategies which might help address the these shortfalls to achieve success in polycentric systems; for example bottom-up initiatives and strategies for scaling up local initiatives (Nastar, 2014); uses of context-specific technology and approach (Pant, 2016); community-driven policy and planning (Pant et al., 2014); establishing strong connections in science and policy interface (Butler et al., 2014; Regmi et al., 2016); and a multi-stakeholder approach (Azhoni et al., 2016; Kuzdas et al., 2015; Nastar, 2014; Srinivasan et al., 2013). Indeed, mirroring scholars focused on the developed context (Armitage et al., 2009; Berkes, 2009; Huntjens et al., 2012), engaging early with diverse actors across different levels of strategic development, alongside open information sharing, is regarded as important for delivering adaptive attributes (Bakkour et al., 2015; Cinner et al., 2012; Satumanatpan et al., 2014). Further, the scholars (from the highly cited developed context) added that diversified actor interactions are important to facilitate (re)arrangements of governance structures, boundaries and practices to improve adaptive capacity (Armitage et al., 2009; Pahl-Wostl, 2009). The developing-context papers have a similar observation and extend this insight by noting that community-driven management responses to crises are

considered an effective approach (Evans et al., 2011; Kuzdas et al., 2015). In particular, they mentioned that the strategies and action plans developed by societal actors typically have greater social acceptance and more on-the-ground compliance by community members (Hossen & Wagner, 2016; Kuzdas et al., 2015). The challenge in the developing contexts is that although diverse-actor involvement is promoted, particularly by donor community representatives, this often becomes a tick-box exercise, rather than framed by increasing individual or organisational adaptive capacity (Bakkour et al., 2015; Butler et al., 2014). As Rouillard et al. (2014) revealed, in practical terms, relevant actors' participation typically remains at 'consultation', with a little or limited contribution to knowledge construction and sharing, conflict resolution, or community empowerment.

Despite repeated calls to facilitate the involvement of local community members in contributing to adaptive decision-making and in instigating demand-driven planning and implementation (Ahammad et al., 2014; Nastar, 2014), this continues to be challenging in developing countries. Indeed, several authors (Benson, Gain, & Rouillard, 2015; Nastar, 2014; Srinivasan et al., 2013) suggest that a new mode of governance ('multiscalar governance', or 'network') can minimize such critical challenges to engage diverse actors and offer platforms for effective participation and collaboration. Further GS insights informing processes of community engagement and response to crisis also offer insight into the social and cultural dimensions of the case context and indicate the level of adaptive capacity achieved (Vargas et al., 2017; Winkel et al., 2016). For example, a Bangladesh study suggests that 'collaboration and strong relationships between various stakeholders are essential components of the climate change adaptation process that help stakeholders build trust, resolve conflicts, and share power, ensuring the participation of many people in the development of climate change adaptation plans and interventions' (Bahauddin et al., 2016, p. 41). Similarly, in Nepal, local adaptation planning aimed 'to bring local and grassroots organizations together by forming different coordination mechanisms and to forge alliances between government and other stakeholders' (Regmi et al., 2016, p. 467). Although the participatory and network approaches in these two cases were not perfect (they failed to define specific roles and responsibilities for the diverse groups of actors), the strategies employed to increase collaboration were successful in leveraging resources to minimize the local vulnerabilities of poor households, generate more localized benefits, and provid a platform for the communities' voices to be heard (Bahauddin et al., 2016; Regmi et al., 2016). Despite these challenges, there remains strong consensus among the authors of the GS papers we reviewed on the need to increase actors' adaptive capacity (see also Clark & Semmahasak, 2013; Satumanatpan et al., 2014).

Overall, this qualitative meta-analysis has pointed that the application of AG approaches supports sustainability transformations in GS (urban) environments and requires attention within the governance context (structure, processes and opportunities). Acknowledging the vast differences in socio-political and institutional development and socio-economic status in GS countries, the analysis revealed an increasing focus on capacity development initiatives aimed at strengthening relevant state and non-state actors' capacity to make effective decisions and improve management approaches (Ahammad et al., 2014; Bakkour et al., 2015; Butler et al., 2014; Nastar, 2014). While this is generally noted by the authors as being dominated by donor strategies and guidance, capacity-building engagements can offer a platform for defining new structures and processes to practice innovative governance strategies and improve the adaptive capacity of the system (Armitage et al., 2009; Pahl-Wostl, 2009).

Attributes for transforming resource and water governance in the global South

The review of empirical studies related to AG in a variety of GS contexts has revealed a growing suite of nuanced understandings related to contextual challenges associated with adopting contemporary governance practices. Overall, the review indicated that despite significant contextual differences between GN and GS countries, AG principles hold across both contexts, albeit with some variation in understanding and manifestation, and from a different 'startline' (i.e. capacity levels). That is, GS countries are starting to recognize their socio-ecological problems, which are far more complex and a bit different from those in the GN and require solution with limited time and resources. GN countries, for instance, have had time (for the last 70 years) to frame their environmental problems and possible solutions, including necessary resources, to look for innovative ideas and processes (Wieczorek, 2018).

For the GS, this meta-analysis outcome emphasizes strategic initiatives to develop institutional and actor capacity as a starting point. To improve capacity, scholars suggest (re)arranging the governance context, i.e., institutional structure and processes, to offer multiple actors' interactions. Indeed, this review outcome generates a common set of enabling factors reminiscent of those suggested by AG scholars. These enablers are interconnected and offer platforms for guiding interventions to be able to deliver adaptive attributes and underpin necessary changes in capacity towards sustainability transformation. These include multilevel and polycentric governance; participatory approaches and networks; and bridging organizations and leadership. Figure 2 is a visual representation of the mentioned context and enablers with identified key AG attributes that emerged from the reviewed case studies as being critical for enabling change in GS countries. We now consider each of these in more depth, drawing on insights from the developing-country case studies we reviewed.
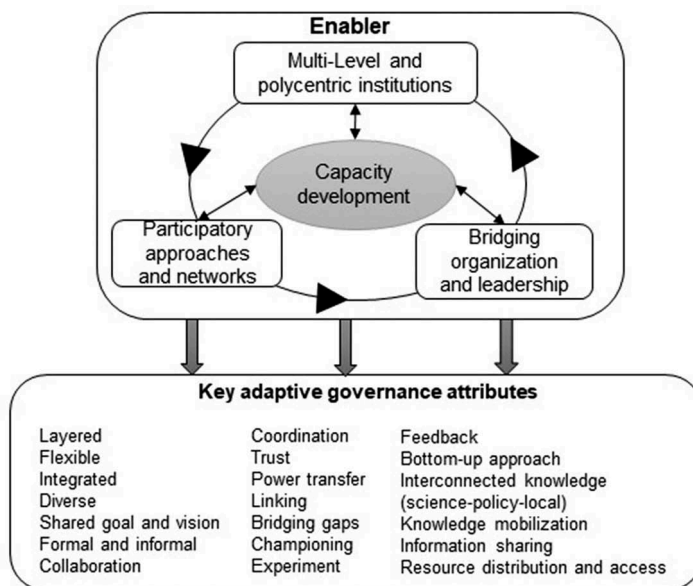
Figure 2. Key adaptive governance attributes and enablers emerging from the global South context.

Multilevel and polycentric governance

The scholars exploring AG in GS contexts call for a change of governance to develop multilevel and polycentric governance systems. The scholars pointed to the potential of this approach to improve institutional and management capacity and thereby support the necessary translation of sustainable water policies into management practices and actively promote social learning processes to build adaptive and sustainable systems involving diverse actors (Ahammad et al., 2014; Azhoni et al., 2016; Mian, 2014; Regmi et al., 2016; Yoseph-Paulus & Hindmarsh, 2018). Multilevel and polycentric governance combines integration of vertical governance scales (e.g. national, state and local) with a horizontal diversity of institutions and actors. This alternative to a centralized, top-down, state-driven system has long been advocated by developed-country scholars, arguing that the emphasis on developing non-state actors' capacity and involvement in decision-making at different implementation scales improves devolution of power and authorizing environments (i.e., polycentricism) (Newig & Koontz, 2014).

The reviewed articles presented evidence that polycentricism supported the resolution of a local water dispute in one case study and led to a shift in communities' behaviours towards sustainable strategies in another (Ahammad et al., 2014; Cinner et al., 2012). The article authors (Ahammad et al., 2014; Azhoni et al., 2016; Cinner et al., 2012; Clark & Semmahasak, 2013) further emphasized that polycentric approaches (including multilevel systems) were necessary to ensure their fit with the social-ecological context; to connect different actor groups and establish formal and informal networks; and to offer relevant linkages across levels of implementation to develop cross-scale interactions, encourage shared understanding and support the scaling-up of innovations (see Table 5 in Butler et al., 2014; Larson et al., 2013; Orchard et al., 2015). This has been evidenced across the regions. While multilevel and polycentric institutions refer specifically to institutional (re)arrangements, they also create a greater opportunity for participatory approaches and networks, which are important features in developing adaptive capacity (Ahammad et al., 2014; Azhoni et al., 2016).

Participatory approaches and networks

Common across all 48 cases studies in the GS was the importance of AG approaches for effective participation of relevant actors to facilitate community-driven planning. In particular, the reviewed cases showed that participatory and network approaches facilitated the involvement of local actors' clusters and their knowledge and experience, which led to better-informed decision making, enabled social learning and thus supported decisions that drove more sustainable outcomes (see Table 4 in Evans et al., 2011; Kuzdas et al., 2015). Many of the initiatives had proven successful in enabling social learning processes, building trust among different stakeholders to minimize conflict, and improving power sharing in a collaborative manner (Bakkour et al., 2015). Further, relevant actors' participation encouraged the coproduction of knowledge (though at different scales) which enabled the development of adaptation strategies (Sowman & Raemaekers, 2018).

AG scholars from both GN and GS emphasize such processes of social learning and formal and informal network development as critical for developing the capacity of the

system towards change (Armitage et al., 2009; Folke et al., 2005; Larson et al., 2013; Orchard et al., 2015; Pahl-Wostl et al., 2007). By way of example from the GS, Larson et al. (2013) revealed how the informal dynamics of social networks in Indonesian water resource management were critical for fostering self-organization and participation, suggesting that this approach would deliver a more robust, resilient and adaptive water sector (see also Orchard et al., 2015). To formulate approaches for sustainable resource management in the GS, evidence-based learning and context-specific under-standing are required to capture relevant political and social learning processes (Evans et al., 2011; Pahl-Wostl, 2007). This is also relevant to the GN, where feedback from learning experiences has been important to ensure coordinated efforts (Armitage et al., 2009; Pahl-Wostl, 2009).

However, though interventions were designed to facilitate stakeholder participation to improve overall actor capacity and decision making, these strategies tended to fail in efforts to strengthen communities' capacity to actively participate in decision-making processes and foster community-facilitated planning and implementation (Ahammad et al., 2014; Nastar, 2014). Such an experience was articulated in the Sri Lankan example of a 'special area management' intervention in Negombo. Communities claimed that the interventions were closed and implemented in isolation, focused on short-term benefit, and had no scope for active community-stakeholder participation (Panditharatne, 2016). This and other similar examples reflect systems in developing-country contexts where centralized state bureau-cracies are reluctant to share decision-making power with community-based organizations, resulting in co-management on paper, but not in practice (Bahauddin et al., 2016; Rouillard et al., 2014). Effective citizen participation is indicated as most crucial for sustainable management practices across the regions, where state actors can play a critical role to ensure effective participation and engagement in decision-making processes.

Bridging organizations and leadership

Similar to the insights derived from the review of GN AG studies, the scholarship on the GS cases also recognizes and promotes the important function of bridging organizations and leadership. GN scholarship has long emphasized bridging organizations as impor-tant facilitators of collaboration and learning (Berkes, 2009; Folke et al., 2005) and as facilitating actors' active participation in environmental management activities (Berkes, 2009; Crona & Parker, 2012), using their own experiences, resource and available funding for collective outcomes. The examples portrayed across the reviewed papers on the GS suggest that such bridging functions have been critical in reducing gaps across different implementation scales, bringing state and non-state actors together in collective action, and negotiating for strengthened participation and collaboration (see Tables 3 and 4 in Clark & Semmahasak, 2013; Hurlbert and Gupta, 2016).

In particular, the emphasis was on the need for knowledge brokers or mediators 'in resolving the underlying differences in stakeholder representation and knowledge con-struction' (Clark & Semmahasak, 2013, p. 882; see also Mian, 2014), which requires transla-tion of sustainable water governance policies to support and explain management outcomes (Butler et al., 2014; Clark & Semmahasak, 2013; Kuzdas et al., 2015). Many of the agencies' facilitation and brokering opportunities are bringing in 'wisdom' from the GN rather than cultivating lessons and appropriate context-relevant strategies for the GS.

Therefore, a tailor-made approach for each individual case is necessary for a successful AG approach in the GS. It should consider the governance context (structure, processes and opportunities; see Table 3), with necessary adjustments and incentives. Although state leadership is critical for the necessary adjustments and incentives, the creativity of local leaders and champions is also vital to increase overall adaptation and resilience.

While there remains scope for further analysis of the suite of roles brokers or mediators play in leading sustainability initiatives, several authors pointed to the important role leaders and champions play in shaping sustainable processes (see Tables 3 and 4 in Ahammad et al., 2014; Clark & Semmahasak, 2013; Kuzdas et al., 2015; Mian, 2014): 'positive governing outcomes are related to the creative efforts of local leaders to overcome governance deficiencies' (Kuzdas et al., 2015, p. 264; see also Sowman & Raemaekers, 2018). These local leaders can act as brokers and mediators to fill in the gaps where the government cannot function for a number of reasons – capacity, capabilities, funding, access, legitimacy, etc. Leadership may come from an individual leader, broker or mediator, a local politician, or groups of people sharing common goals. Leaders and champions can also mediate improvements in coordination and networking to use collective initiatives (Hurlbert and Gupta, 2016).

Concluding remarks

This article has examined the contemporary and emerging insights from the global North and South related to enabling attributes that support the successful operationalization of AG for a shift towards sustainable resource management. While many studies focus on AG and the capabilities required to support change, there is little in the way of a coherent guiding approach to understanding the effective implementation of AG. Although the broader conceptualization that has emerged from the GN benefits the GS, adoption of AG attributes and principles faces significant challenges in the context of institutional inertia and capacity issues. These challenges are also common to the GN, although as mentioned earlier, there are different manifestations and 'startlines'. The significant challenges associated with persistent institutional barriers and a lack of relevant actors' capacity, which continue to impede the application of AG principles, are critical for the GS. As mentioned, conventional institutional arrangements are typically rigid, inflexible and not aimed at driving change through policy learning and power sharing among stakeholders (Mian, 2014; Panditharatne, 2016). Similar analyses of GN contexts have found that sustainable resource governance is not possible if institutional arrangements are not conducive to facilitating necessary learning and developing actors' response capacity (Pahl-Wostl, 2007; Ostrom, 2010).

This meta-analysis reveals key insights on 'emerging' and 'proposed' attributes as a result of practising AG in diverse socio-political contexts. These adaptive attributes are critical for governing the SES (i.e., water) in the GS context through improving the adaptive capacity of the relevant institutions and actors. This article highlights particular reference to cases where scholars indicate that the 'emergent' attributes are supporting AG principles on the ground for managing the SESs. They also point to the attributes (i.e. 'proposed') to overcome the challenges arising from the on-the-ground practices to achieve sustainable outcomes. Further analysis of the reviewed papers reveals a series of

enablers of change, which appear important for driving and supporting AG in developing countries. These enablers are interconnected and offer changes for shaping resource management system towards sustainability. These enablers include multilevel and polycentric governance; participatory approaches and networks; and bridging organizations and leadership. While these generally reinforce the ideas that have been derived through studies of the GN, this article revealed their particular manifestations and nuances in the GS context. The enablers can also provide a guiding framework for considering how to support the investigation of different structures and processes driving or inhibiting change at different scales. Future research could consider further developing and testing these enablers and attributes for use in diagnosing the degree to which they are present in a system as a means of shaping strategic interventions to drive sustainability transformations.

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References

Adger, W. N. (2006). Vulnerability. *Global Environmental Change*, *16*(3), 268–281. doi:10.1016/j.gloenvcha.2006.02.006

Ahammad, R., Hossain, M. K., & Husnain, P. (2014). Governance of forest conservation and co-benefits for Bangladesh under changing climate. *Journal of Forestry Research*, *25*(1), 29–36. doi:10.1007/s11676-014-0430-9

Ansell, C., & Gash, A. (2008). Collaborative governance in theory and practice. *Journal of Public Administration Research and Theory*, *18*(4), 543–571. doi:10.1093/jopart/mum032

Armitage, D. R., Plummer, R., Berkes, F., Arthur, R. I., Charles, A. T., Davidson-Hunt, I. J., … McConney, P. (2009). Adaptive co-management for social–Ecological complexity. *Frontiers in Ecology and the Environment*, *7*(2), 95–102. doi:10.1890/070089

Atkinson, R., & Flint, J. (2001). Accessing hidden and hard-to-reach populations: Snowball research strategies. *Social Research Update*, *33*(1), 1–4.

Azhoni, A., Holman, I., & Jude, S. (2016, April). Contextual and interdependent causes of climate change adaptation barriers for water management: Responses from regional and local institutions in Himachal Pradesh, India. In EGU General Assembly Conference Abstracts (Vol. 18), Vienna, Austria.

Bahauddin, K. M., Rahman, N., & Hasnine, M. T. (2016). Environmental reviews and case studies: Public perception, knowledge, and participation in climate change adaptation governance in the Coastal Region of Bangladesh using the Social Ecological Inventory (SEI) Tool. *Environmental Practice*, *18*(1), 32–43. doi:10.1017/S1466046615000393

Bakkour, D., Enjolras, G., Thouret, J. C., Kast, R., Mei, E. T. W., & Prihatminingtyas, B. (2015). The adaptive governance of natural disaster systems: Insights from the 2010 mount Merapi eruption in Indonesia. *International Journal of Disaster Risk Reduction*, *13*, 167–188. doi:10.1016/j.ijdrr.2015.05.006

Benson, D., Gain, A. K., & Rouillard, J. J. (2015). Water governance in a comparative perspective: From IWRM to a'nexus' approach?. *Water Alternatives*, *8*(1), 756–773.

Berkes, F. (2009). Evolution of co-management: Role of knowledge generation, bridging organizations and social learning. *Journal of Environmental Management*, *90*(5), 1692–1702. doi:10.1016/j.jenvman.2008.12.001

Berkes, F., & Ross, H. (2013). Community resilience: Toward an integrated approach. *Society & Natural Resources*, *26*(1), 5–20. doi:10.1080/08941920.2012.736605

Berrang-Ford, L., Pearce, T., & Ford, J. D. (2015). Systematic review approaches for climate change adaptation research. *Regional Environmental Change*, *15*(5), 755–769.

Biggs, E. M., Duncan, J. M., Atkinson, P. M., & Dash, J. (2013). Plenty of water, not enough strategy: How inadequate accessibility, poor governance and a volatile government can tip the balance against ensuring water security: The case of Nepal. *Environmental Science & Policy*, *33*, 388–394.

Bown, N. K., Gray, T. S., & Stead, S. M. (2013). Co-management and adaptive co-management: Two modes of governance in a Honduran marine protected area. *Marine Policy*, *39*, 128–134.

Brunner, R. D., Steelman, T. A., Coe-Juell, L., Cromley, C. M., Tucker, D. W., & Edwards, C. M. (2005). *Adaptive governance: Integrating science, policy, and decision making*. New York: Columbia University Press.

Butler, J. R. A., Suadnya, W., Puspadi, K., Sutaryono, Y., Wise, R. M., Skewes, T. D., ... Kisman, M. (2014). Framing the application of adaptation pathways for rural livelihoods and global change in eastern Indonesian islands. *Global Environmental Change*, *28*, 368–382. doi:10.1016/j.gloenvcha.2013.12.004

Celliers, L., Rosendo, S., Coetzee, I., & Daniels, G. (2013). Pathways of integrated coastal management from national policy to local implementation: Enabling climate change adaptation. *Marine Policy*, *39*, 72–86. doi:10.1016/j.marpol.2012.10.005

Chaffin, B., Gosnell, H., & Cosens, B. A. (2014). *A decade of adaptive governance scholarship: Synthesis and future directions*. Ecology and Society, *19*(3), 56.

Cinner, J. E., Daw, T. M., McClanahan, T. R., Muthiga, N., Abunge, C., Hamed, S., ... Jiddawi, N. (2012). Transitions toward co-management: The process of marine resource management devolution in three east African countries. *Global Environmental Change*, *22*(3), 651–658. doi:10.1016/j.gloenvcha.2012.03.002

Clark, J. R., & Semmahasak, C. (2013). Evaluating adaptive governance approaches to sustainable water management in north-west Thailand. *Environmental Management*, *51*(4), 882–896. doi:10.1007/s00267-012-9993-4

Clemens, M., Rijke, J., Pathirana, A., Evers, J., & Hong Quan, N. (2016). Social learning for adaptation to climate change in developing countries: Insights from Vietnam. *Journal of Water and Climate Change*, *7*(2), 365–378.

Cosens, B. A. (2013). Legitimacy, adaptation, and resilience in ecosystem management. *Ecology and Society*, *18*(1). doi:10.5751/ES-05093-180103

Crona, B. I., & Parker, J. N. (2012). Learning in support of governance: Theories, methods, and a framework to assess how bridging organizations contribute to adaptive resource governance. *Ecology and Society*, *17*(1). doi:10.5751/ES-04534-170132

Cundill, G., Cumming, G., Biggs, D., & Fabricius, C. (2012). Soft systems thinking and social learning for adaptive management. *Conservation Biology*, *26*(1), 13–20. doi:10.1111/j.1523-1739.2011.01755.x

Dietz, T., Ostrom, E., & Stern, P. C. (2003). The struggle to govern the commons. *Science*, *302*(5652), 1907–1912. doi:10.1126/science.1091015

Evans, L., Brown, K., & Allison, E. (2011). Factors influencing adaptive marine governance in a developing country context: A case study of Southern Kenya. *Ecology and Society*, *16*(2). doi:10.5751/ES-04084-160221

Falk, T., Bock, B., & Kirk, M. (2009). Polycentrism and poverty: Experiences of rural water supply reform in Namibia. *Water Alternatives*, *2*(1), 115.

Farrelly, M. A., Rijke, J., & Brown, R. R. (2012). Exploring operational attributes of governance for change. In WSUD 2012: Water sensitive urban design; Building the water sensitive community; 7th international conference on water sensitive urban design (p. 244). Engineers Australia. doi:10.1094/PDIS-11-11-0999-PDN

Folke, C. (2006). Resilience: The emergence of a perspective for social–Ecological systems analyses. *Global Environmental Change*, *16*(3), 253–267. doi:10.1016/j.gloenvcha.2006.04.002

Folke, C., Carpenter, S., Elmqvist, T., Gunderson, L., Holling, C. S., & Walker, B. (2002). Resilience and sustainable development: Building adaptive capacity in a world of transformations. *AMBIO*: *A Journal of the Human Environment*. *31*(5), 437–441.

Folke, C., Carpenter, S., Walker, B., Scheffer, M., Elmqvist, T., Gunderson, L., & Holling, C. S. (2004). Regime shifts, resilience, and biodiversity in ecosystem management. *Annual Review of Ecology, Evolution and Systematics*, 35, 557–581.

Folke, C., Hahn, T., Olsson, P., & Norberg, J. (2005). Adaptive governance of social-ecological systems. *The Annual Review of Environment and Resources*, 30, 441–473. doi:10.1146/annurev.energy.30.050504.144511

Grady, A., Gersonius, B., & Makarigakis, A. (2016). Taking stock of decentralized disaster risk reduction in Indonesia. *Natural Hazards and Earth System Sciences*, 16(9), 2145–2157. doi:10.5194/nhess-16-2145-2016

Gupta, J., Termeer, C., Klostermann, J., Meijerink, S., van Den Brink, M., Jong, P., ... Bergsma, E. (2010). The adaptive capacity wheel: A method to assess the inherent characteristics of institutions to enable the adaptive capacity of society. *Environmental Science & Policy*, 13(6), 459–471. doi:10.1016/j.envsci.2010.05.006

Halbe, J., Pahl-Wostl, C., Sendzimir, J., & Adamowski, J. (2013). Towards adaptive and integrated management paradigms to meet the challenges of water governance. *Water Science & Technology*, 67(11), 2651–2660. doi:10.2166/wst.2013.146

Hossen, M. A., & Wagner, J. R. (2016). The need for community inclusion in water basin governance in Bangladesh. *Bandung*, 3(1), 1–17.

Huntjens, P., Lebel, L., Pahl-Wostl, C., Camkin, J., Schulze, R., & Kranz, N. (2012). Institutional design propositions for the governance of adaptation to climate change in the water sector. *Global Environmental Change*, 22(1), 67–81. doi:10.1016/j.gloenvcha.2011.09.015

Hurlbert, M, & Gupta, J. (2016). Adaptive governance, uncertainty, and risk: policy framing and responses to climate change, drought, and flood. *Risk Analysis*, 36(2), 339–356.

Hurlbert, M., & Gupta, J. (2017). The adaptive capacity of institutions in Canada, Argentina, and Chile to droughts and floods. *Regional Environmental Change*, 17(3), 865–877. doi:10.1007/s10113-016-1078-0

Karpouzoglou, T., Dewulf, A., & Clark, J. (2016). Advancing adaptive governance of social-ecological systems through theoretical multiplicity. *Environmental Science & Policy*, 57, 1–9. doi:10.1016/j.envsci.2015.11.011

Kuzdas, C., Wiek, A., Warner, B., Vignola, R., & Morataya, R. (2015). Integrated and participatory analysis of water governance regimes: The case of the Costa Rican dry tropics. *World Development*, 66, 254–268. doi:10.1016/j.worlddev.2014.08.018

Larson, S., Alexander, K. S., Djalante, R., & Kirono, D. G. (2013). The added value of understanding informal social networks in an adaptive capacity assessment: Explorations of an urban water management system in Indonesia. *Water Resources Management*, 27(13), 4425–4441. doi:10.1007/s11269-013-0412-2

Mian, S. (2014). Pakistan's Flood Challenges: An assessment through the lens of learning and adaptive governance. *Environmental Policy and Governance*, 24(6), 423–438. doi:10.1002/eet.v24.6

Mistry, J., Berardi, A., Roopsind, I., Davis, O., Haynes, L., Davis, O., & Simpson, M. (2011). Capacity building for adaptive management: A problem-based learning approach. *Development in Practice*, 21(2), 190–204. doi:10.1080/09614524.2011.543272

Nastar, M. (2014). What drives the urban water regime? An analysis of water governance arrangements in Hyderabad, India. *Ecology and Society*, 19(2). doi:10.5751/ES-06570-190257

Newig, J., & Koontz, T. M. (2014). Multi-level governance, policy implementation and participation: The EU's mandated participatory planning approach to implementing environmental policy. *Journal of European Public Policy*, 21(2), 248–267. doi:10.1080/13501763.2013.834070

Nguyen, Q. A., Miller, F., Bowen, K., & Tan Sinh, B. (2017). Evaluating capacity for climate change adaptation in the health and water sectors in Vietnam: Constraints and opportunities. *Climate and Development*, 9(3), 258–273. doi:10.1080/17565529.2016.1146118

Olsson, P., Folke, C., & Berkes, F. (2004). Adaptive comanagement for building resilience in social–Ecological systems. *Environmental Management*, 34(1), 75–90. doi:10.1007/s00267-003-0101-7

Orchard, S. E., Stringer, L. C., & Quinn, C. H. (2015). Impacts of aquaculture on social networks in the mangrove systems of northern Vietnam. *Ocean & Coastal Management*, *114*, 1–10. doi:10.1016/j.ocecoaman.2015.05.019

Ostrom, E. (2010). Polycentric systems for coping with collective action and global environmental change. *Global Environmental Change*, *20*(4), 550–557.

Pahl-Wostl, C. (2007). Transitions towards adaptive management of water facing climate and global change. *Water Resources Management*, *21*(1), 49–62. doi:10.1007/s11269-006-9040-4

Pahl-Wostl, C. (2009). A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes. *Global Environmental Change*, *19*(3), 354–365. doi:10.1016/j.gloenvcha.2009.06.001

Pahl-Wostl, C., Lebel, L., Knieper, C., & Nikitina, E. (2012). From applying panaceas to mastering complexity: Toward adaptive water governance in river basins. *Environmental Science & Policy*, *23*, 24–34. doi:10.1016/j.envsci.2012.07.014

Panditharatne, C. (2016). Institutional barriers in adapting to climate change: A case study in Sri Lanka. *Ocean & Coastal Management*, *130*, 73–78. doi:10.1016/j.ocecoaman.2016.06.003

Pant, L. P. (2016). Paradox of mainstreaming agroecology for regional and rural food security in developing countries. *Technological Forecasting and Social Change*, *111*, 305–316. doi:10.1016/j.techfore.2016.03.001

Pant, L. P., KC, K. B., Fraser, E. D., Shrestha, P. K., Lama, A. B., Jirel, S. K., & Chaudhary, P. (2014). Adaptive transition management for transformations to agricultural sustainability in the Karnali Mountains of Nepal. *Agroecology and Sustainable Food Systems*, *38*(10), 1156–1183.

Plummer, M. L. (2009). Assessing benefit transfer for the valuation of ecosystem services. *Frontiers in Ecology and the Environment*, *7*, 38–45. doi:10.1890/080091

Plummer, R., Armitage, D., & De Loë, R. (2013). Adaptive comanagement and its relationship to environmental governance. *Ecology and Society*, *18*(1). doi:10.5751/ES-05383-180121

Ranabhat, S., Ghate, R., Bhatta, L. D., Agrawal, N. K., & Tankha, S. (2018). Policy coherence and interplay between climate change adaptation policies and the forestry sector in Nepal. *Environmental Management*, *61*(6), 968–980. doi:10.1007/s00267-018-1027-4

Regmi, B. R., Star, C., & Leal Filho, W. (2016). Effectiveness of the local adaptation plan of action to support climate change adaptation in Nepal. *Mitigation and Adaptation Strategies for Global Change*, *21*(3), 461–478. doi:10.1007/s11027-014-9610-3

Rijke, J., Brown, R., Zevenbergen, C., Ashley, R., Farrelly, M., Morison, P., & van Herk, S. (2012). Fit-for-purpose governance: A framework to make adaptive governance operational. *Environmental Science & Policy*, *22*, 73–84. doi:10.1016/j.envsci.2012.06.010

Rouillard, J. J., Benson, D., & Gain, A. K. (2014). Evaluating IWRM implementation success: Are water policies in Bangladesh enhancing adaptive capacity to climate change impacts? *International Journal of Water Resources Development*, *30*(3), 515–527. doi:10.1080/07900627.2014.910756

Satumanatpan, S., Senawongse, P., Thansuporn, W., & Kirkman, H. (2014). Enhancing management effectiveness of environmental protected areas, Thailand. *Ocean & Coastal Management*, *89*, 1–10. doi:10.1016/j.ocecoaman.2013.12.001

Seeliger, L., & Turok, I. (2014). Averting a downward spiral: Building resilience in informal urban settlements through adaptive governance. *Environment and Urbanization*, *26*(1), 184–199.

Shrestha, M. K. (2013). Internal versus external social capital and the success of community initiatives: A case of self-organizing collaborative governance in Nepal. *Public Administration Review*, *73*(1), 154–164.

Sowman, M., & Raemaekers, S. (2018). Socio-ecological vulnerability assessment in coastal communities in the BCLME region. *Journal of Marine Systems*, *188*, 160–171.

Srinivasan, V., Seto, K. C., Emerson, R., & Gorelick, S. M. (2013). The impact of urbanization on water vulnerability: A coupled human–Environment system approach for Chennai, India. *Global Environmental Change*, *23*(1), 229–239.

Srinivasan, V. (2015). Reimagining the past–use of counterfactual trajectories in socio-hydrological modelling: the case of Chennai, India. *Hydrology and Earth System Sciences*, *19*(2), 785–801.

Sultana, P., Thompson, P., & Green, C. (2008). Can England learn lessons from Bangladesh in introducing participatory floodplain management? *Water Resources Management*, *22*(3), 357–376.

UN (2015). Transforming our world: The 2030 agenda for sustainable development. New York: United Nations. Retrieved from http://bit.ly/TransformAgendaSDG-pdf.

UN. (2018). *World economic situation and prospects*. New York: Department of Economic and Social Affairs, United Nations. Retrieved from https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/publication/WESP2018_Full_Web-1.pdf

Vargas, R., Alcaraz-Segura, D., Birdsey, R., Brunsell, N. A., Cruz-Gaistardo, C. O., de Jong, B., ... Loescher, H. W. (2017). Enhancing interoperability to facilitate implementation of REDD+: Case study of Mexico. *Carbon Management*, *8*(1), 57–65.

Walch, C. (2019). Adaptive governance in the developing world: Disaster risk reduction in the State of Odisha, India. In *Climate and Development* (pp. 1–15).

Walker, B., Holling, C. S., Carpenter, S. R., & Kinzig, A. (2004). Resilience, adaptability and transformability in social–Ecological systems. *Ecology and Society*, *9*(2), 5.

Wieczorek, A. J. (2018, Jun). Sustainability transitions in developing countries: Major insights and their implications for research and policy. *Environmental Science & Policy*, *1*(84), 204–216.

Winkel, T., Bommel, P., Chevarría-Lazo, M., Cortes, G., Del Castillo, C., Gasselin, P., ... Tourrand, J. F. (2016). Panarchy of an indigenous agroecosystem in the globalized market: The quinoa production in the Bolivian Altiplano. *Global Environmental Change*, *39*, 195–204.

Yoseph-Paulus, R., & Hindmarsh, R. (2018). Addressing inadequacies of sectoral coordination and local capacity building in Indonesia for effective climate change adaptation. *Climate and Development*, *10*(1), 35–48.

2.6 Summary

This chapter reviews relevant literature to identify the current knowledge gaps relating to sustainable urban water management (SUWM) implementation and provides a detailed understanding of the theoretical perspectives that inform this research. While AG and ST scholars have identified relevant concepts and frames that can inform a transformation towards SUWM implementation, this has rarely been translated from the GN to GS contexts. Therefore, we remain constrained in understanding the potential value of these various research traditions for enabling transformative change towards SUWM in developing countries.

The concept of AG has emerged and flourished in recent decades, providing theories and practices for addressing complex environmental problems in the GN, although they may not have been reflected in mainstream practices (Karpouzoglou et al., 2016; Sharma-Wallace, Velarde and Wreford, 2018). In particular, its application to the GS context still lacks knowledge regarding relevant strategies and the enabling context required to support the adoption of AG principles leading to SUWM implementation. The literature review includes a deep engagement with adaptive governance scholarship and application, with particular focus on GS implementation, and identified key adaptive attributes and enablers. Empirical insights to test these findings remain to be developed in order to address real-world problems and explore the potential value of this pluralist research approach in progressing new understandings of AG.

Scholarly evidence and policy rhetoric reveals that GS countries are undergoing significant policy change to enable growth with sustainable management of water resources where 'water governance crisis' is marked as critical (Biswas and Tortajada, 2010; Pahl-Wostl, 2017). Further, reviewing AG applications in the GS context emphasises 'capacity issues' and highlighted capacity attributes and enablers to deal with these governance crises. However, there remains a lack of empirical evidence to support such insights and improve the level of adaptive capacity developed over the time. Therefore, it is valuable to collect and analyse detailed, empirical information about the historic and contemporary city-scale context of governance approaches to assess the level of adaptive capacities required over time to transform a system.

Chapter 3

Research Methodology

3.1 Introduction

This chapter presents the methodology developed for undertaking this PhD research, including the research philosophy, overall design and logics. The rationale for undertaking the case study approach and a justification for selecting Bangladesh's urban water governance as a research context is also included. This chapter explains the research objectives and relevant questions that guided the scope of the research. A research design was developed systematically to guide approaches in data collection and analysis in relation to the research objectives.

3.2 Research philosophy

The research aims to unpack the understanding of adaptive governance (AG) in underpinning a change in water governance practices to drive the sustainable transformation of urban water systems in a global South (GS) context. A pragmatist philosophy (see Creswell, 2009) guides this research, which examines social issues, seeks possible solutions to the identified problems and provides scope for flexibility in research methodology. In addition, a pragmatic view offers academic and professional knowledge to shape insights (Denscombe, 2008) and further to understand complex real-world context based on the research question and the aim the study (Saunders, Lewis, Thornhill and Wilson, 2009). Accordingly, with this pragmatic approach, this research investigates the complex and wicked urban water governance system in a global South context and further seeks to identify the underlying governance challenges for understanding sustainable urban development pathways by exploring the social, historical and political contexts of the urban water system (Creswell, 2009). This pragmatic approach utilises qualitative social research methods to develop insights into the contemporary city-scale governance strategies and actor engagement to influence innovation and transition processes in the existing urban water systems.

3.3 Research design and logic

The research design has adopted an 'emergent design flexibility', which suggests 'openness to adapting inquiry as understanding deepens and/or situations change (Patton, 2002, p. 40). Under this design flexibility, this research involved undertaking qualitative methods that linked conceptual theory development with empirical investigations that takes place in real-world settings and there are scope for collecting thick data and description. The empirical investigation included examining city-scale strategies to identify AG attributes and associated

enablers responsible for guiding sustainable governance approaches in a GS context. The first stage involved detailed literature-based research to develop the conceptual framework for data collection and analysis, which was then tested and validated using empirical data. According to Blaikie (2009, p. 180) such conceptual underpinning can provide 'abstract descriptions of the regularities or episodes under consideration and … to construct "images" of mechanisms', which in turn can be used to organise empirical findings and observations.

The research design has been built upon a case study logic established by Yin (2014, p. 17): 'unlike many other research designs, the case study can cope with situations in which there are many more variables of interest than data points (the complex urban water system), relies on multiple sources of evidence and benefits from prior theoretical prepositioning'. Following Yin's (2013) assertion that understanding some conceptual framing before examining a case study is important, this research has generated a conceptual understanding of how key processes and actions related to AG and sustainability transitions (STs) are understood in the global North (GN) and GS world settings by reviewing relevant academic disciplines (see chapter 2). Specifically, the multi-level perspective (MLP) and AG framings have been used to guide data collection and analysis.

This research incorporated several qualitative research strategies that are well suited to studying the research problem. As outlined by Creswell (2013), a pragmatic view of the real-world situation requires approaching the topic from different perspectives and using different methods. Figure 3.1 provides an overview of the research design and logic. Adopting a single, embedded case study design (see Yin, 2013), data were collected using narrative research methods (e.g. oral histories and in-depth interviews; see section 3.5.1).
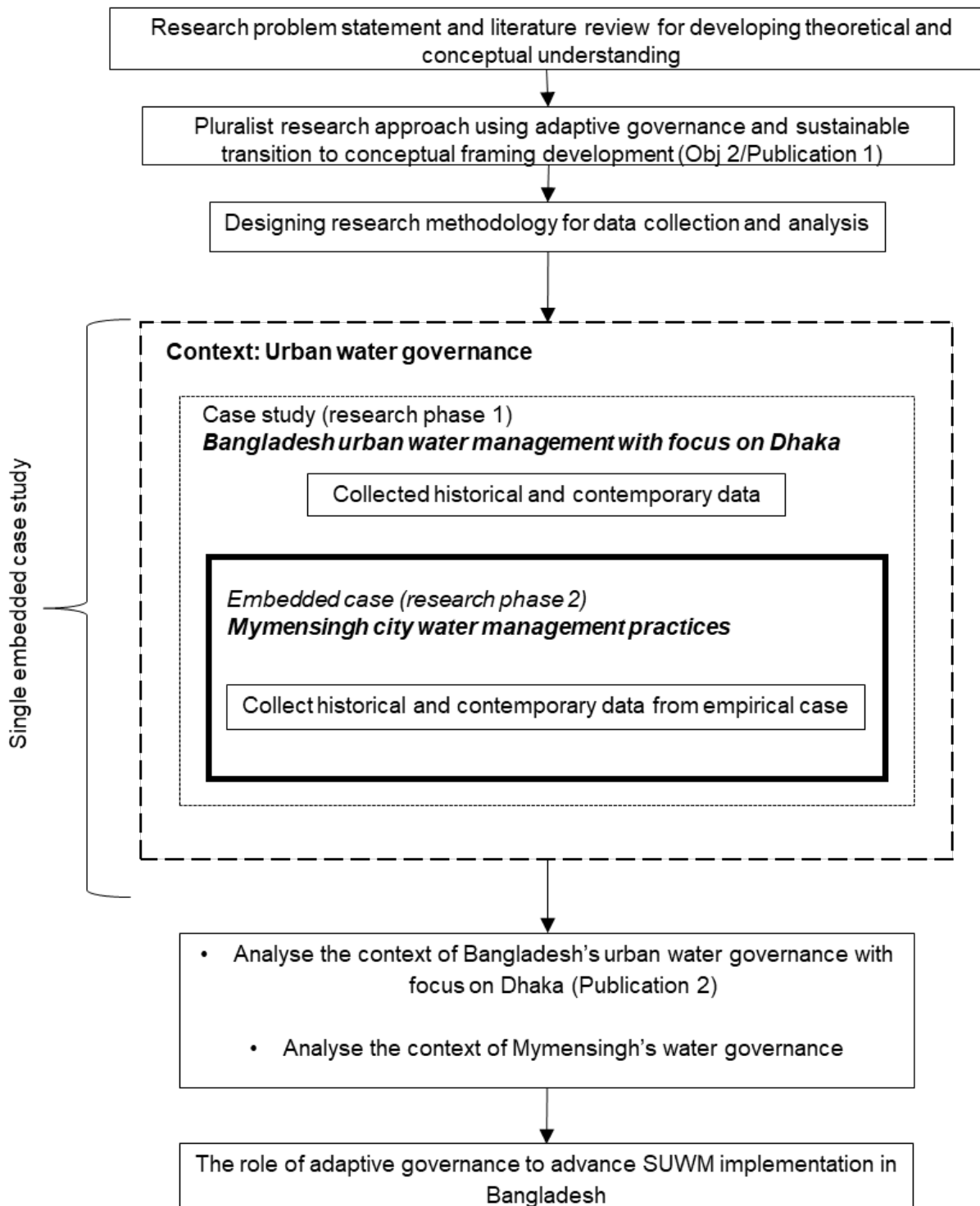
Figure 3.1 PhD research design and logic

3.4 Embedded case study and research context

A single embedded case study approach enables a detailed examination of contemporary phenomena (urban water governance) in its real-life context (urban water management system). An embedded case study is suitable when logical subunits in a single case study (i.e. a larger unit of analysis) can be identified and examined in depth (Yin, 2013). With the single embedded cases, the unit of analysis was the urban water governance context; however, these case studies also operated to explain details of governance trends and contemporary approaches in a descriptive mode (Yin, 2009). The single embedded case study approach is advantageous as it can offer extensive analysis and enhance insights into a single case. Yet it can also be problematic if too much attention is given to the subunits and there is a failure to connect to the larger unit of analysis (Yin, 2013). To address that potential problem, this research investigated these two case studies separately and took measures to link the embedded units to the phenomena of interest, primarily through the research objectives.

The research involved two phases of data collection and analysis. The first phase involved exploring urban water governance in Bangladesh, represented in the city of Dhaka. The second phase involved exploring the embedded unit, the city of Mymensingh. The results from the two case studies were drawn upon to assist in understanding how to advance SUWM implementation in Bangladesh.

3.4.1 Research context

The single-embedded case study approach (Yin, 2013) was adopted in the research context of Bangladesh, a relatively young country seeking to improve living standards by ensuring food and water security and further economic prosperity to become a middle income country by 2021 (Perspective plan of Bangladesh 2010–2021). Acknowledging the problem arising from rapid urbanisation, including a shortage of services and deteriorating environmental conditions, in particular within urban boundaries, this country is dedicated to achieving sustainability targets along with expected economic growth (Bangladesh SDGs progress report, 2018). This vision of economic development along with ensuring urban sustainability not only includes Dhaka and other urban centres in Bangladesh (Perspective plan of Bangladesh 2010–2021). The Bangladesh Bureau of Statistics (BBS, 2011) classifies all urban centres into four categories:

(i) The megacity (a population more than 5 million Dhaka the only megacity in Bangladesh).

(ii) Statistical Metropolitan Areas (SMAs) (City Corporations and adjoining areas with urban characteristics, which includes three cities: Chittagong (3.39 million), Khulna (1.34 million) and Rajshahi (0.7 million).

(iii) Pourashavas (currently 209 urban centres mostly at the district and subdistrict scale as declared by local government authorities).

(iv) Other urban areas (subdistrict headquarters and significant market places within rural boundaries that have sealed roads, good infrastructure services (e.g. communication, electricity, gas, water and sewerage) and a higher density of population in non-agricultural occupations. Across these urban areas, there are currently four water supply and sewerage authorities (WASA) (one in the megacity and three in SMAs) which work with City Corporations in managing urban water, while the City Corporations and Pourashavas serve the remaining areas

This research focuses on the megacity of Dhaka as the larger unit of study, given its political, cultural and economic importance; and on one Pourashava, Mymensingh, as the smaller unit of analysis, for it is a rapidly growing urban settlement that is exploring infrastructure and governance options to support broader vision of sustainable urban development (see Figure 3.1). Basic urban service delivery, in particular water and water-related services in Bangladesh, is facing myriad challenges (Akber, Horen, Minnery and Smith, 2007; Moinuddin, 2013; 2010; Rana, 2011;), including rapidly growing urban populations and related urbanisation trends and bio-geophysical constraints associated with being situated on the world's largest delta (such as river-basin flooding) (Rana, 2011).

These challenges threaten the ambition to become a middle-income country by 2021 (Gain and Schwab, 2012). In addition, Bangladesh is highly vulnerable to the frequent and intense extreme climatic events anticipated under climate change projections (Benson et al., 2015; Gain et al., 2013). Responding to these pressures, alongside an emphasis on economic development and sustainability agendas, broader government policy documents have begun reflecting the need for significant improvements in water governance activities, and beyond, in Bangladesh (Gain and Schwab, 2012; Moinuddin, 2013). Nevertheless, implementation is lagging and gaps between policy and implementation strategies have been increasing over time (Gain and Schwab, 2012).
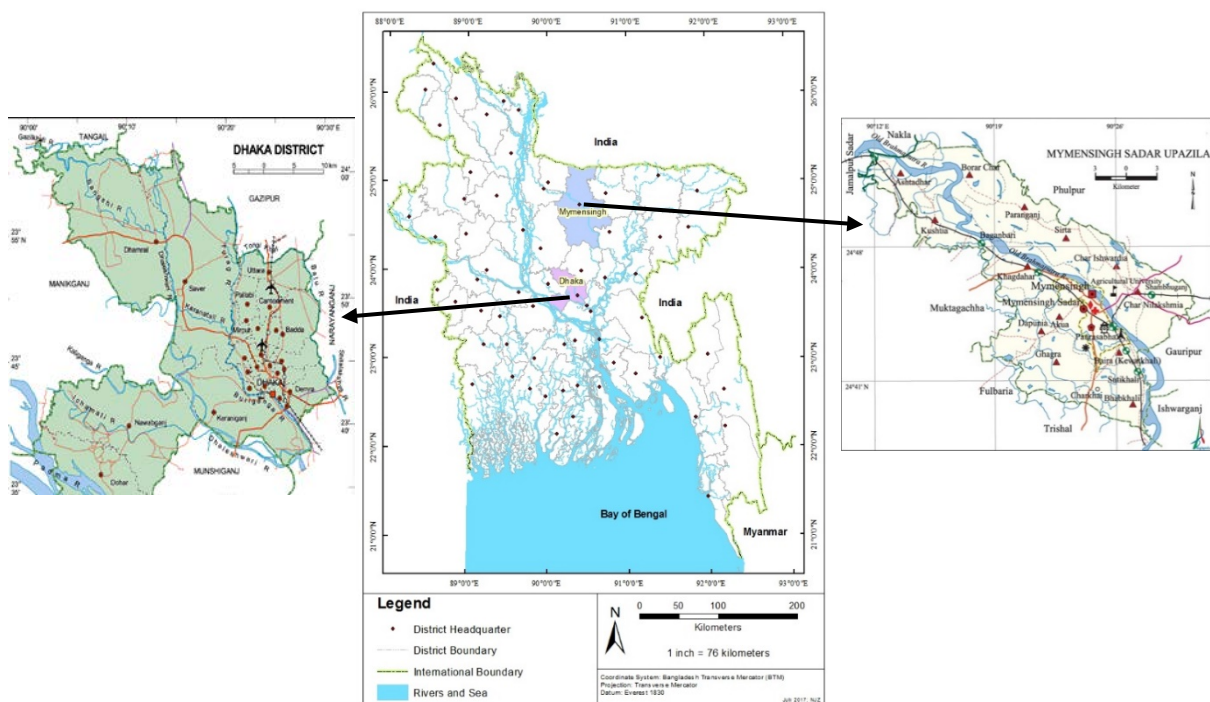
Figure 3.1 Research case locations map: the larger unit is Dhaka and smaller unit is Mymensingh Sadar Upzilla. 'Sadar Upzilla' is a local term for city.

The institutional context of urban water management in Bangladesh involves multiple actors across different operational levels, including: government agencies, local government institutions such as specialised water utilities (e.g. WASAs, DPHE), Pourashavas (a local term for a municipality) and city corporations, which collectively provide water supply and sanitation services. The Local Government Division (LGD) oversees and controls the activities of these government agencies. To assist with water management, in the early 1990s, 173 catchments were identified and grouped into sixty planning areas and then further aggregated into five regions (NWMP, 2004). Despite this delineation, responsibilities for catchment planning remain with the national water resource council (NWRC) and the water resource planning organisation (WARPO). Water supply and sanitation in primary cities (such as Dhaka and Chittagong) is necessarily a public sector responsibility, and there are autonomous organisations at the city level. Pourashavas are responsible for all water-related services within the boundaries of secondary cities (i.e. Mymensingh, Jessore, Faridpur). The governance parameters of Pourashavas are weak and poorly addressed (LGED-UNDP, 2010). Councils generally run Pourashavas in an autocratic manner, and most of them lack planning and resources for providing services to the people (LGED-UNDP, 2010). Pourashavas are incapable of generating revenue themselves due to poor human resources and a lack of planning

for development and improvements in services. Pourashava rely mostly on government subsidies and have weak governance capacity.

Mymensingh Pourashava

Mymensingh is known as the 'city of education' due to the presence of many well-reputed educational institutions, such as the Medical School and the Girls Cadet School. According to the MSDP Socio-economic report (2015), due to its proximity to Dhaka, several important government institutions contribute to the city's economy (service-related activities comprise 20% of it). This report also identified that the city's economy is largely dependent on agricultural activities (60%) despite business (small and medium enterprises) being labelled the dominant occupation. Industrial activity is accounts for less than 10 per cent of the economy.

Situated on the banks of the old Brahmaputra River and 120 kilometres from the capital Dhaka, Mymensingh City (Map 3.1) covers 82 square kilometres and on average is 19 metres above sea level. Mymensingh has a moderate, cooler climate than Dhaka, for it is closer to the Himalayas (Wikipedia, 2018). Mymensingh Pourashava was established in April 1869 and as of 2017 consisted of twenty-one wards (Pourashava report, 1972) and ninety-five slum settlements scattered across the city. Based on revenue (i.e. household tax, services tax and/or fees) collected over the three years to 2017, Pourashavas in Bangladesh are categorised as 'A', 'B' or 'C', where 'A' group revenue is more than or equal to BDT 6 million, B = BDT 2.5 million and C = BDT 1 million (Urban Management unit, LGED: <http://www.lged.gov.bd/UnitAbout.aspx?UnitID=10>. Mymensingh Pourashava is classified as 'A', based on revenue collection of BDT 6 million (USD 70,878.42 at a conversion rate of BDT 1= USD 0.012). As of 2017, Mymensingh Pourashava had the capacity to supply one-third of its total water needs via piped water, covering approximately 15 per cent of households (MSDP, 2015). To supplement water supplies, households typically draw from individual or shared tube-wells and street hydrants, increasing water coverage to 46 per cent of the population including slum communities (MSDP, 2015). For sanitation, approximately 93 per cent of the Mymensingh Poursharva population uses some form of latrine including septic tanks, ventilated and pit latrines (MSDP, 2015).

Population: 407798 (BBS, 2010)
Population density: 5000/sq. KM
Monsoon temperature: 15 ~ 20 °C
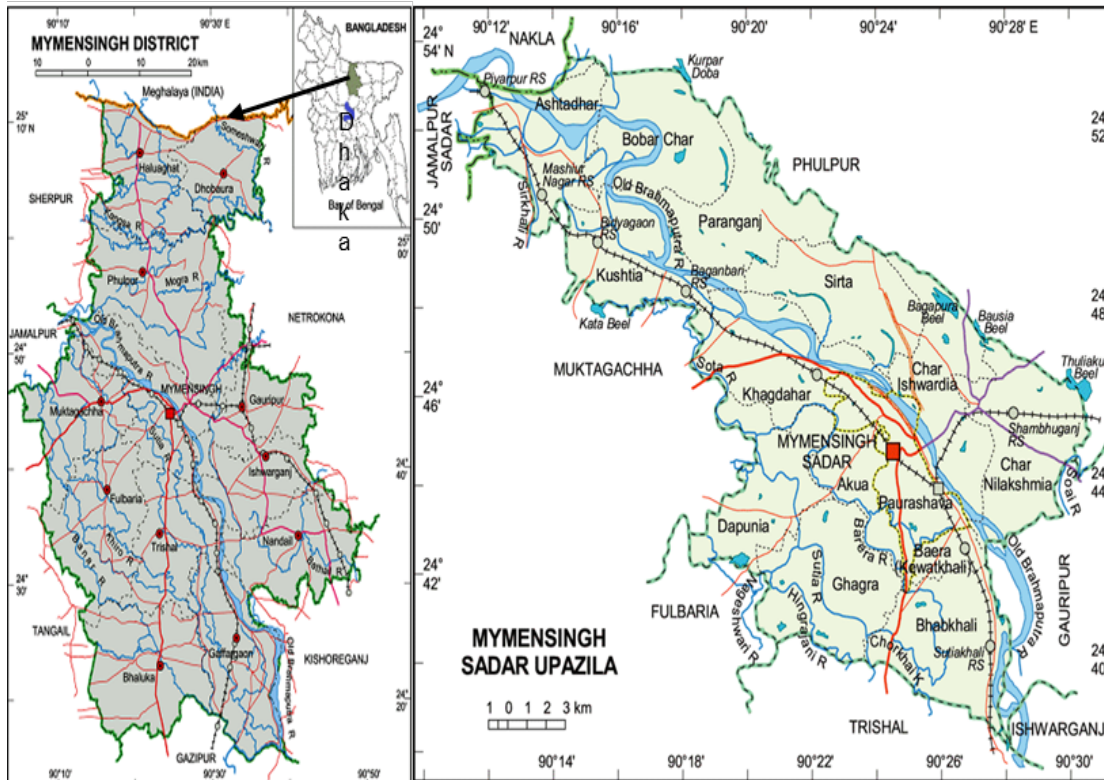
Figure 3.2 Mymensingh District and Sadar Upzilla (city) Map

3.5 Research methods

This section clarifies the scope and procedures underpinning this research project. It details and justifies the selection of research methods for each objective in the research design (see Figure 3.1) to ensure the different elements of the research design are consistent with each other while also making the research decisions explicit (Blaikie, 2000). As this is a thesis with publications, there is some duplication on research methods, but the following presents a comprehensive account of how the research was undertaken.

Objective 1: *To identify the characteristics and attributes of adaptive governance that underpin sustainability transformation in global South (developing) contexts.*

This objective was formulated to engage with contemporary scholarship regarding adaptive governance and identify key conceptual and scholarly understandings related to and/or recognised as adaptive attributes underpinning changes in sustainable resource management. The rationale of the study outlined in chapter 1 presented the core of the debates in

contemporary understanding of water governance crises and the associated challenges of advancing sustainable urban water management in global North and South contexts. This led to identifying a key scholarly gap in existing knowledge and to developing a conceptual framework that captures AG attributes and enablers to advance SUWM in global South contexts.

This is in response to the debates regarding the utility of concepts and frameworks around AG and SUWM that are constructed based on GN experience and the limited understanding of the extent to which these frameworks are applicable in GS contexts. The key research questions included: What are the dominant theoretical frameworks and tools available in AG scholarship relevant to guiding a sustainable transition? How have countries implemented AG and what relevant attributes and strategies were adopted to support sustainable transformation? What constitutes an enabling context to support the delivery of adaptive attributes and capacity for sustainability transformations in GS contexts?

Following a detailed scholarly review of scholarship associated with environmental and water governance, AG and ST, as outlined in chapter 2, this analysis revealed AG principles and practices were largely based on practical experience in the GN. Therefore, further analysis was required to understand how these concepts and insights have contributed to adaptive governance in GS contexts. This involved undertaking a meta-analysis of the peer-reviewed journals to identify empirical GS cases where AG thinking is applied (as detailed in chapter 2, Publication 1, pp. 38–60). This resulted in the development of a synthesis framework of adaptive capacities and attributes (the ACA framework) and pointed to the enabling conditions required to guide SUWM transformations in GS contexts. The ACA framework in turn guided interview questions for the units of embedded case study research and was applied to analyse collated empirical data (Objective 2). A summary of the methods utilised for this objective is presented in Table 3.1.

Table 3.1 Methodological summary for research objective 1

Research Objective 1				
To identify the characteristics and attributes of adaptive governance that underpin sustainability transformation in developing contexts.				
Research Questions	**Research Method**	**Data source**	**Data analysis**	**Validation method**
1. How have developing countries implemented adaptive governance principles and what relevant strategies have been adopted to support sustainable transformation?	Literature review and framework development	The literature on key concepts and attributes of adaptive governance and application of identified attributes and concepts in the global South context.	A systematic approach to collation of review articles and identifying attributes and enablers.	External audit
2. What constitutes an enabling context to support the adoption of adaptive governance principles for supporting sustainability transformation?		The literature on adaptive governance, sustainable transition and enablers.	Synthesising the understanding of the attributes and key enablers suited to the global South context.	

Objective 2: *To characterise the evolution of adaptive capacities that underpin city-scale water governance practices in Bangladesh.*

The second research objective was designed to investigate historical and contemporary urban water governance approaches in Bangladesh. Key research questions included: What are the characteristics of traditional urban water governance regimes in Bangladesh and how did they evolve? What were the critical attributes of AG available in the contemporary city-scale governance practices and how are these moving the governance regime towards SUWM in Bangladesh? These questions also sought to validate and refine the synthesis framework, and generate new understandings of the reality of engaging in urban water governance in the two Bangladeshi cities. This informed the iterative nature of the research design, whereby the synthesis framework (developed in Objective 1) was further refined as empirical data emerged.

Objective two is underpinned by the thinking that Bangladesh has a rich history of shifting governance and development paradigms (e.g. public health, flood management, food security etc.) that are influenced by distinct socio-political contexts, the geomorphological landscape and agrarian-based economy (Rana, 2011; Benson et al., 2015). This is reflected in the wider water resource governance in Bangladesh, which has largely focused on developing irrigation and drainage systems, to promote agrarian-based economic development. The urban water governance system, by contrast, has largely been Dhaka-centric (Moinuddin, 2010). Therefore, the historical perspective of city-scale governance practices largely focused on Dhaka.

However, as mentioned earlier (section 3.4.1), the Bangladeshi Government is seeking to achieve middle-income country status by 2021, thus greater attention is being paid to other cities, in particular emerging secondary cities such as Mymensingh, which have benefited from several projects and strategic guidance to improve urban water systems. Based on this thinking, the research strategy employed an embedded case study approach where a broader unit looked at Bangladesh's urban water development, with a focus on Dhaka; and a smaller unit examined Mymensingh, an emerging secondary city involved in project-scale initiatives to improve the access to water and sanitation services.

The empirical cases are presented in chapters 4 and 5. The analysis of the larger unit, Dhaka, involved examining the changes in urban water governance practices and associated approaches over a 250-year period. Study of the smaller unit, Mymensingh, involved a more detailed analysis of the contemporary city-based, multi-scale strategies aimed at improving governance capacity to deliver sustainable services, including water and sanitation.

Data collection involved primary and secondary sources guided by the ACA framework. Oral histories (n=17) were used as the source of primary data for the larger unit analysis and semi-structured interviews including face-to-face formal interviews (n=36) and informal group discussions (n=22) were the source of primary data for the smaller unit. Detailed media analyses (1878–2016) were used for both cases (see section 3.5.1). The multiple sources of evidence were analysed and triangulated to corroborate and/or contrast with the findings (Yin, 2014).

Interviews (oral histories and semi-structured interviews)
Two interview techniques were used to collect primary data. Phase one data collection included using oral history data collection techniques to capture a broader perspective on the changes in practices over time and involved the larger unit (broader Bangladesh with a focus on Dhaka). Phase two, on the other hand, used semi-structured interviews to capture specific details of changes over time, focusing on contemporary practices in Mymensingh. A purposeful sampling strategy and a snowballing method applied to select interviewees (Creswell, 2007). In total 53 interviews were conducted with leading urban water practitioners to examine how contemporary urban water governance approaches have shifted in Dhaka (a megacity) and Mymensingh (an emerging city). Section 3.5.1 discusses these interview approaches. In addition, media analysis of newspaper reports from 1878 to 2016 helped to derive an

understanding of the socio-political context of the associated periods. Following data analysis, an extensive validation process was undertaken to test the research findings (Table 3.2). The validation included a review of policy reports, legislation, regulation and media documentation to support, specify and/or contradict interviewee interpretations. Moreover, validation interviews and workshops were conducted for both cases with representatives of key stakeholder groups who had been interviewed and with individuals who had an overview of water resource management in Bangladesh. Overall, the ACA framework and MLP used for guiding and collection of empirical data across the cases.

Table 3.2: Methodological summary for research objective 2

Research Objective 2				
To characterise the evolution of adaptive capacities that underpin city-scale water governance practices in Bangladesh.				
Research questions	**Research Method**	**Data sources**	**Data analysis**	**Validation method**
1. What are the characteristics of the traditional urban water governance regime in Bangladesh and how has this evolved over time? 2. Which critical attributes of adaptive governance are available in the contemporary city-scale governance practices in Bangladesh? 3. How are these moving governance regimes towards sustainable transformation?	Empirical case analysis in two cities in Bangladesh. Larger unit of analysis (Dhaka) Smaller unit of analysis (Mymensingh)	Relevant scientific publications, policy materials and national reports; organisational literature (i.e government agencies and peak industry reports); relevant project proposals, annual reports, project reports, committee meeting minutes and reports, workshop presentation documents, industry and professional association literature and scientific literature.	Line by line reading and memo writing, line by line coding of the data, developing themes, interpreting and developing a qualitative chronology and narratives for a generalised understanding	Member checking, peer debriefing, pattern matching and external audit.

Objective 3: *To reveal how adaptive governance principles and practices facilitate sustainability transition in urban Bangladesh.*

Scholars acknowledge adaptive governance has captured scientific and policy interest for dealing with complex sustainability issues (e.g. water); however, they also highlight the need for relevant empirical evidence from diverse socio-political and economic contexts (Chaffin et al., 2014; Hurlbert and Gupta, 2016). To provide such an empirical context and extend the understanding of the structure and processes of adaptive governance principles, this research

argues that bridging with theories and perspectives from sustainable transitions can guide more accurate empirical inquiry into the unfolding governance arrangements in Bangladesh.

As described under Objective 2, data collection entailed the extensive gathering of primary and secondary material to construct case narratives that detail past and contemporary governance practices that led to the conception and implementation of urban water practices in two Bangladeshi cities. Further detail on the data collection procedures is discussed in section 3.4.3. The primary data analysis employed a line by line reading and coding for systematic development into the thematic and descriptive content (Creswell, 2013). This involved identifying changes observed in institutional setups over time, technological advances, key actors and processes that were contributing towards change. Following Yin's (2009) principle of pattern matching, the combined data sources were examined to identify whether the capacity attributes stated in the ACA framework were present within real world activities. The emerging patterns were explored and organised and if possible, compared, to infer, interpret and distinguish the different periods of political activity and key governance mechanisms from the empirical data. This strengthens the internal validity of the result. The comparison is necessary when there are two cases and it helps the external validity of the findings (Yin, 2009). For further validation, the understanding developed through the case analysis was discussed with the key informants in each city for feedback and the findings were also subjected to member checking (Creswell, 2007).

Table 3.3: Methodological summary for research objective 3

Research Objective				
To reveal how adaptive governance principles and practices facilitate sustainability transition in *urban Bangladesh*.				
Research question	**Research method**	**Data sources**	**Data analysis**	**Validation method**
How do adaptive governance principles and practices facilitate the implementation of SUWM in the context of urban Bangladesh.	Analysis of the two cases, Dhaka and Mymensingh, and reflection of the understanding in refining the conceptual framework of adaptive capacity and attributes and possible transition pathways.	Empirical materials from the two cases (See Table 2.2)	Empirical material was coded, aggregated into themes and interpreted to develop understanding of adaptive governance mechanisms in context.	Member checking

3.5.1 Data collection and analysis in two cities

Multiple field site visits were undertaken for scoping and intensive data gathering initially for four months (April to August) in 2016 and then again for two months (February and March) in 2017. Data collection and analysis were undertaken in two phases. Phase one involved exploring the changing paradigm of Bangladesh's urban water governance with a focus on Dhaka, while the second phase involved examining the changing water governance paradigm in Mymensingh. A summary of data collection techniques and dimensions of interviewees and their group specification for two cities is presented in Table 3.4.

Table 3.4: Summary of data collection campaigns in Dhaka and Mymensingh

Data and Interviewees dimensions	Bangladesh urban water management with key focus on Dhaka (DUWM)	Mymensingh Urban Water Management (MUWM)
Primary data	Oral history collection (n=17) and media analysis (1878 to 2016)	Face-to-face formal interviews (n=36) Informal group discussions (n=22)
Secondary data	Relevant scientific publications and policy material and national reports; organisational literature (i.e government agencies and peak industry reports); industry and professional association literature and scientific literature.	Relevant scientific, peak industry publications and policy material and national reports, relevant project proposals, annual reports, project reports, committee meeting minutes and reports, workshop presentation documents and scientific literature
Interviewees' dimensions	Retired and higher level (directorate/ sectoral experts) government officials, NGO representatives and policy activists in different organisations involved in water management, including academics (n=4), national level consultants (n=3), government professionals (n=5) and NGO professionals (n=5)	Among the 36, 14 participants were Mymensingh Pourashava and council staff involved in management and implementation activities within the Pourashava boundary, e.g. the mayor and a Pourashava representtive. The remaining participants (n=22) were from different organisations, such as community committee members, NGO workers, academics based in Mymensingh, project personnel (government and non-government) based in Dhaka and civil society activists linked with municipality activities

Phase one data collection procedures

Primary data was collected in seventeen face-to-face oral history interviews with key informants who have lived through different social-historical and political periods and observed significant changes in urban water management. This oral history interview format can produce rich, thick data with details of an individual's experience of the phenomenon of interest; it helps to map out how the phenomenon of interest evolved; and it allows for eliciting participant perspectives on events and experiences through storytelling and description (Dilley, 2004). To determine whether there were flaws, limitations or other weaknesses in the interview design protocols (Turner III, 2010) and to provide an opportunity to refine interview questions,

a pilot study was conducted with three informants. The outcome of this pilot study supported enabled adjustment and refinement of interview questions.

The oral history interviews were selected (Creswell, 2014) to facilitate the development of a theory that explains the guidance towards sustainable urban water management in Bangladesh. Relevant stakeholders in urban water governance practices were selected from four groups (see Table 3.4) following initial discussions with individuals involved in Dhaka's water management system. Additional interviewees were selected using snowball sampling, whereby participants were asked to identify other relevant experts in the field (Creswell, 2014).

Interview schedules differed depending on the type of the oral history interviews. Initially the oral histories were loosely structured to support a full narrative description of the interviewees' reflections of the developments in urban water management in Bangladesh. However, after three interviews it became clear that adjustments to questions were needed to capture more relevant and specific content on the phenomena of key interest. The interview schedule presents a list of open-ended questions and indicative probes used to explore interviewees' recollections. Seventeen oral histories were undertaken and the interview questions explored informants' involvement with the industry; their perceptions of management priorities and how these have changed over time; what drove or inhibited those changes; experiences with collaborative management and participatory approaches; and finally the strengths and weaknesses of the contemporary water management system.

The oral history interviewees had worked in or studied the Bangladesh urban water sector for at least the last eighteen years, with seven individuals each having more than thirty years' experience. Interviews were conducted in private meeting rooms in the participants' workplace and ranged from one to two hours, but most lasted approximately one hour. Interviews were generally audio-recorded enabling the researcher to focus on what was being said (Bryman, 2004), or if not recorded due to interviewee preference, detailed handwritten notes were taken. After the interviews, the audio recordings were transcribed; if not recorded, the handwritten notes were typed as soon as possible. To allow for more open responses, all interviewees were assured their opinions would remain anonymous, therefore encouraging the interviewees to discuss pertinent issues and how they should be resolved. Summary notes and short memos were also documented as soon as practicable after interviews to capture the researcher's initial ideas and reflections.

Of the interviewees, four were professors at high-ranking universities in Bangladesh and had been engaged in consultations and policy formulation. Three of the interviewees were retired government officials; however, they were then engaged in high-level consultations for improving water resource management in Bangladesh. Five government employees also interviewed for the research were working in management for different departments looking specifically urban water-related issues. The remaining five interviewees were in the development sector and specialised in water supply management and sanitation for informal settlements and small urban areas. Among these five interviewees, two were well known environmental activists working on such issues as safe drinking water and faecal sludge management.

Primary data collection included extensive media analysis, which was undertaken to capture further insights into and reflections on key events, which helped frame the dominant discourses of the time. Newspaper articles from 1878 to 2016 were analysed and sorted according to key search terms (see Table 3.5). Relevant articles were then arranged chronologically to generate a timeline of urban water development in Bangladesh's water sector. The analysis focused on identifying institutional changes over time, technological advances, key stakeholders and processes contributing to change, evidence of network developments, description of collaborative initiatives, general public opinion, priorities, visions and goals, political motivations and external influences. The media content analysis was then cross-referenced with narratives generated through oral histories. Additionally, secondary data sources, including relevant policy statements, along with industry and professional association literature were reviewed to establish any convergence or divergence in the overarching narrative (Further details of the secondary data sources mentioned in Publication 2, p. 92).

Table 3.5 Phase one data collection processes

Data collection				
	Methods	Sources		Dimensions
Primary data	Oral history (n=17)	Across different organisations involved in water management such as academics (4), national level consultants (3), government professionals (5), and NGO professionals (5)		Retired and higher level (directors/sectoral experts), Government officials. Higher-level authority in NGOs, policy activist and professors.

	Media analysis (1878 to 2016)	Monash library web portal
		• South Asian Newspaper Archives
		• ProQuest Historical Newspapers
		• The Guardian and the Observer
		• Dhaka Tribune
		National newspaper (Bangladesh)
		    • The Daily Star
		    • Prothom Alo
		    • Daily Ittefaq
		Available online news searching with the key terms in google.com.bd
				Key terms for online news search-
				
				Water Urban water
				Dacca * Bangladesh
				Bengal Water
				Sanitation management
				Cholera Water supply
				East Pakistan WASA
				Canal dispute Dhaka
				River Pourashava/
				Water pollution Municipalities

Secondary data	Policy materials and national reports, organisational literature (e.g. government agencies and peak industry reports), industry and professional association literature and scientific literature.			

*Before 1982 Dhaka was spelt 'Dacca'.

Primary and secondary data were collated and systematically reduced into thematic and descriptive content, following Creswell (2013), while looking for patterns of convergence and divergence among source materials. Initial analysis involved line-by-line coding of the transcribed interview data, which were then grouped under identified periods of development (e.g. British, Pakistan, and Bangladesh periods). The multi-level perspective was used as a guide to unpack activities at different levels (see Table 3.6) and each period's events/activities were then analysed for different viewpoints associated with crucial changes. The ACA framework was then applied to assess the level of adaptive capacity achieved through those changes over the time periods.

This work also draws on the conceptualisation of the 'hydro-social contract (HSC)', which refers to the implicit understanding of management arrangements between government and community, legitimised in a historical, unwritten contract where governments protected

broader society from resource access conflict, in particular access to water (Brown et al., 2009a; Lundqvist et al., 2001; Farrelly and Brown, 2014). HSC understands water management as an evolution of interactions between actors and institutional connections across horizontal and vertical directions. Therefore, data from actors and interactions in the different periods were also analysed.

Table 3.6 Structured analysis questions through the lens of the MLP framework

Scales	*Key questions*
Landscape	i. What pressures (internal and external) influence Bangladesh water resource management interventions? ii. What drivers or barriers are responsible for creating such pressures in Bangladesh's water sector? iii. What are the relationships between those pressures, drivers and barriers in the context of urban water management in Bangladesh?
Regime	i. What are the management visions, guiding principles, and approaches to governance interventions in the water sector? ii. How have these management visions, guiding principles and approaches influenced urban water management? iii. What changes occurred in urban water management due to such interventions?
Niche	i. What key activities/changes occurred in Bangladesh's urban water sector? ii. How well have the different niches informed and created change?

Phase two data collection procedures

The second phase of data collection narrowed in on the smaller unit of analysis, the city of Mymensingh. Data collection included (i) collating and analysing newspaper articles (1878 to 2016) from newspaper archives available on Monash University library's data base, 'Newsbank-Australia and the world', and (ii) reviewing the Pourashava's annual reports and water supply datasheet. The second stage involved mapping and examining contemporary water management approaches by identifying existing water supply and sanitation systems, and a detailed examination of two key urban water management projects. The two urban water management projects were selected for their unique project strategies and implementation approaches, and being 'new-to-context' in Bangladesh, including emphasising improved governance and facilitating bottom-up implementation. In addition, both projects were highly relevant to developing urban water-related service delivery and explicitly facilitated active community engagement. These two key projects, summarised below, were used to frame the semi-structured interviews, but this did not constrain interviewees from talking about other key engagements and activities they had been involved with.

Project 1 Second Urban Governance and Infrastructure Improvement Sector Project

Commonly referred to as UGIIP-II, the Second Urban Governance and Infrastructure Improvement Sector Project commenced in 2011, building on the lessons learned from the original project (UGIIP-I, 2003–2010), which aimed to provide infrastructure development and capacity building training to Pourashava staff in selected secondary cities of Bangladesh (ADB-Bangladesh report, 2015). Funded by the Asian Development Bank (ADB), this project was designed to improve the functionality of the urban utility service provider, the Local Government Engineering Department (LGED), by focusing on developing local infrastructure and improving local governance capacity (ADB-Bangladesh report, 2015). The key emphasis of UGIIP-II is to motivate participating Pourashavas to improve their governance functions by ensuring citizen participation, particularly the inclusion of women, the poor and minority groups in Pourashava activities. UGIIP-II's project completion report of 2015, along with an evaluation study undertaken in 2016, supported the design of the third phase, which was under consideration at the time of interviewing (February–July 2017).

Project 2 The Mymensingh Strategic Development Plan (2011–2031)

The development of the Mymensingh Strategic Development Plan (MSDP) is one of several long-term initiatives undertaken by the Bangladeshi Government, led by the Urban Development Directorate and funded by the United Nations Development Programme (MSDP, 2015). This long-term project aims to ensure basic services are delivered to urban communities, by improving community resilience through increasing formal and informal participation and collaboration within and between government agencies, with non-government organisations, and broader civil society. The Mymensingh Pourashava has been actively involved in this project, from the design phase through to implementation, and a key step was the twenty-year master plan to boost the Pourashava's capacity to envision the city's resilience. Details of the master plan can be found at <http://www.udd.gov.bd/site/publications/3cadb66c-c1fb-490f-ba99-b76936365de1/Mymensingh-Strategic-Development-Plan-MSDP-2011--2031 and at their website, http://www.msdp.gov.bd/ .

Further data collection included face-to-face semi-structured interviews with key stakeholders and several informal group sessions in Mymensingh city. The objectives of the semi-structured interviews were to identify whether the critical attributes of adaptive governance were present

and whether these attributes were assisting with improving the adaptive capacities to guide Mymensingh's urban water system towards sustainability. Thirty-six semi-structured interviews were conducted in Bangla, a language in which interviewees and the lead researcher are fluent, as they provided flexibility in responding to issues raised during the interview (Bryman, 2004). An interview schedule (Bryman, 2004), including questions, was prepared prior to fieldwork.

Interview participants were selected based on their involvement in the Pourashava's water management activities (as mentioned above, 'Pourashava' is the local term for a municipality and responsible for conducting city-building activities in Mymensingh, including water management). The interviews explored professional engagement in the industry, capacity-development activities (as an individual or institutions) to deal with the growing crises (e.g. groundwater depletion, surface water pollution), the participation and collaboration among relevant stakeholders and critical engagement with knowledge production and sharing platforms. The audio-recorded interviews explored a number of key themes: level of professional engagement (i.e engineers, planners) in decision-making; whether existing individual and organisational capacities could address the increasing water crises; and the mechanisms and opportunities for stakeholder engagement, participation and collaboration.

The mayor and key actors from the Pourashava management committee were identified as important informant interviews and were asked to identify other relevant experts in the field, based on the snowball method as described in Creswell (2013). Town-level and ward-level coordination committee (TLCC and WLCC respectively) members were identified as potential participants and interview schedules differed depending on the activities they were involved in. Fourteen interviewees were directly engaged with Pourashava day-to-day water-related services while the remaining twenty-two were actively involved in different organisations working in water management in Mymensingh and linked with the Pourashava's activities. Interviews were conducted in private meeting rooms in participants' workplaces and ranged from forty-five to ninety minutes, but typically lasted one hour. Similar processes were used to capture data from the interviews (e.g. audio recording or, if not recorded due to interviewee preference, detailed notes were taken). After the interviews, the audio recordings were transcribed; if not recorded, the handwritten notes were typed as soon as possible. To allow for more open responses, all interviewees were assured their opinions would remain anonymous, encouraging the interviewees to discuss pertinent issues currently faced and how they should

be improved. Summary notes and short memos were also documented as soon as practicable after interviews to capture the researcher's initial ideas and reflections.

Informal group discussions typically included three or four individuals (in most cases these were people involved in the primary semi-structured interviews) engaging in facilitated discussions with the researcher regarding patterns and trends in the sector. The informal settings meant there was no provision for audio recording, but detailed notes were taken, focusing on key concepts discussed and relevant future directions regarding the sector (Table 3.7). Although the informal discussion was not part of the original research design, this approach afforded an opportunity to engage participants in open discussion, to ground data collection and validate early insights. Notes of these informal sessions were taken in Bangla, transcribed and then translated into English for further analysis.

Table 3.7 Phase two data collection methods

	Methods	Dimensions
Primary data	Face-to-face, audio-recorded, formal interviews (n=36)	Among the 36 interviewees, 14 represented the Mymensingh Pourashava and council staff who are actively involved in management and implementation activities within the pourashava boundary (e.g the mayor and Pourashava representatives). The remaining participants (n=22) were from different organisations, such as community committee members, NGO workers, academics based in Mymensingh, project personnel (government and non-government) based in Dhaka) and civil society activists linked with municipality activities.
	Informal group stakeholder discussions (22 individuals in four group discussions)	
Secondary data	Collation and review of relevant documentation from national and municipality scale policy material, national reports, relevant project proposals, annual reports, project reports, committee meeting minutes and reports, workshop presentation documents and scientific literature.	

The primary and secondary data collected in the second phase were analysed in line with the MLP and ACA framings to capture the following: changes in the governance regime identified in institutional reforms and evolving actor engagements in multi-level interactions; evidence of stakeholders bridging gaps by collaborative efforts, and new network building and capacity-development initiatives. Here evidence includes project/ Pourashava reports, newspaper and newsletter coverage. Secondary data analysis was then compared against interview data cross-referencing and validation.

3.6 Summary

This chapter presents the research methods used to achieve the objectives and overall aim of this PhD thesis. The previous chapter described the relevant literature on adaptive governance in particular focus on GS and developed a guiding framework. This framework, featuring adaptive attributes and enablers, contributed to the research methods by guiding data collection and analysis processes. A single embedded case study approach was used and data collection involved oral history data, semi-structured interviews, media content analysis and extensive secondary data collection to examine whether AG principles that are present can drive a transition to SUWM practices in Bangladesh. This involved, first, focusing on Dhaka as a broader representation of urban Bangladesh and, second, examining Mymensingh as an emerging secondary city and how these are evolving in the sustainable trajectory development in Bangladesh.

The next chapter presents the findings from the case study Bangladesh with a focus on Dhaka (Phase 1). The chapter identifies five key shifts in governance processes and presents an assessment of adaptive capacities that underpin the sectoral development in Bangladesh's urban water system. Following this, chapter 5 presents the findings from the Mymensingh case study (Phase 2).

Chapter 4

Urban Water Governance in Bangladesh

4.1 Introduction

As outlined in chapter 2, examining how the multiple levels, structures and processes that underpin urban water governance in Bangladesh have changed over time can assist in identifying embedded pathways and ongoing challenges associated with the capacity to transform the urban water sector. Utilising multi-level perspective framing to guide data collection and analysis, this chapter presents a historical and contemporary analysis of evolving urban water governance practices in Bangladesh. In addition, contemporary adaptive governance scholarship was utilised to provide insights into whether the levels of adaptive capacity have improved (or not) in the urban water system of Bangladesh. By unpacking the evolutionary processes and practices that have informed the contemporary governance regime, this chapter seeks to examine the change over time regarding the various actors and initiatives and to identify how these have informed (or not) sectoral changes. The purpose is to provide an insight into opportunities for improving the adaptive capacity of urban water governance.

While the research initially sought to examine change over time in relation to urban water governance across Bangladesh, the chapter has a focus on Dhaka, as the historical, economic and political centre of Bangladesh. This focus emerged given the 250-plus years of historical development and associated governance approaches in Bangladesh's urban water system. This led to the designation of five distinct periods of development across essential water infrastructure and services associated with the provision of water supply, sanitation and drainage. The analysis then explored the relationships and interdependencies across the landscape-regime-niche levels of operation that sought to reveal actor-oriented and institutional adaptive capacities within the urban water system.

The next section presents a paper published in *World Development* (vol. 109, pp. 386–400).

4.2 Publication 2

Evolution of water governance in Bangladesh: An urban perspective

Evolution of water governance in Bangladesh: An urban perspective

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A B S T R A C T

Within the context of urban transformations, water governance has received global attention due to its growing complexities in responding to wicked and multifaceted challenges, such as rapidly growing populations, increased resource demand and uncertain climate futures. To date, much of the empirical research on water governance and urban transformations has examined developed cities, with limited investigation of developing cities. This paper therefore aims to enrich current empirical insights regarding the evolution of, and key shifts within urban water governance in Bangladesh. Drawing on recent developments in sustainability transitions and urban water governance scholarship, the paper charts 250 years of water resource development in Bangladesh. Analysis of primary and secondary qualitative data sources revealed five major periods between 1757 and 2016 that represent key changes to governance approaches that underpinned sectoral changes. Although the shifts in governance approaches have cumulatively improved the adaptive capacity of Bangladesh's urban water system, they have not been framed to provide guidance and facilitation for driving on-ground change, which may be inhibiting a sustainable transformation of Bangladesh's urban water sector. Nevertheless, the insights do provide important foundations for informing the development of new governance models capable of dealing with multi-scale strategies for supporting a sustainability transformation.

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1. Introduction

Cities worldwide are rethinking conventional urban water management in response to increasing environmental degradation, rapidly growing urban populations, resource vulnerabilities, and uncertain climate change impacts (Biswas & Tortajada, 2010; Brown, Keath, & Wong, 2009). Scholars have proposed various pathways for transforming urban systems, including the conceptualizations of Sustainable Urban Water Management (SUWM) (Gleick, 2003; Mitchell, 2005; Newman, 2001; Pahl-Wostl, 2008), Integrated Water Resources Management (IWRM) (Mitchell, 2005), and Water Sensitive Cities (Brown et al., 2009). Collectively, these approaches challenge the stationary of conventional urban water management practices and call for a transformation of governance to accommodate polycentric, horizontal and hybrid institutional and practical arrangements towards improving the adaptive capacity of the overall technological and management system (Gleick, 2003; Pahl-Wostl, 2008; Van de Meene, Brown, &

Farrelly, 2011). Among these conceptualizations, the IWRM concept has received broad acceptance (Agyenim & Gupta, 2012; Biswas, 2008; Rouillard, Benson, & Gain, 2014), particularly in the nations with emerging economies (e.g. Bangladesh, India, and Indonesia) where it has been mainstreamed within different policies and strategic planning processes to improve the water management system. IWRM promotes strategies that integrate different parts of the water cycle and modern technologies for water management (Agyenim & Gupta, 2012; Biswas, 2008). IWRM implementation, however, remains less successful (Biswas & Tortajada, 2010; Pahl-Wostl & Sendzimir, 2005), which scholars explain is a result of vague understandings of the concept and a lack of guiding frameworks for implementation (Biswas & Tortajada, 2010; Pahl-Wostl & Sendzimir, 2005). This has led global policy and research interest in water resource management towards exploring governance challenges and mechanisms, particularly within urban environments (Biswas & Tortajada, 2010). Urban water governance refers to the institutional and organizational structures and processes responsible for managing, regulating and provisioning water services at different levels of society living within an urban boundary (Pahl-Wostl, 2007).

Both scholarly and policy domains have highlighted the need to reconsider urban water paradigms and pivot towards more

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sustainable water management regimes (Gleick, 2003; Mitchell, 2005; Newman, 2001). Ideally, a sustainable water management regime would deliver attributes and strategies that establishes good governance principles, alongside sustainable resource management (Brown et al., 2009; Pahl-Wostl, 2007). While Fig. 1 presents a comparison between conventional and sustainable urban water regimes, there remains a growing call for further analysis of the emergent patterns within these complex, inter-related societal and policy processes, particularly within the contemporary urban sustainability research domain (Wolfram, 2016). By doing so, scholars argue that patterns of change for guiding contemporary and future governance strategies towards sustainable urban water development may become apparent (Ferguson, Brown, & Deletic, 2013; Wolfram, 2016).

Within the urban water governance domain, there has been limited scholarly analysis or evidence related to: (i) exploring and understanding governance change processes; (ii) the gaps arising and lessons learned from the multiple scale interactions inhibiting changes on-ground; and, (iii) the level of adaptive capacities (capacity of a system to adapt if the environment where the system exists is changing) required over time for transforming a system (see, e.g. Biswas & Tortajada, 2010; Ferguson et al., 2013; Pahl-Wostl, 2008). Contemporary urban water research, particularly in developing countries, has largely focussed on how successful (or not) the application of IWRM has been (see e.g. Benson, Gain, & Rouillard, 2015; Gain & Schwab, 2012; Rouillard et al., 2014), its relationship to transboundary water management (e.g. Ojendal et al., 2012), and, has remained primarily in capital city urban areas, leaving emerging urban areas underexplored with regard their potential for alternative water development trajectories. Thus, this paper begins from the position that unpacking the historical and contemporary governance patterns related to water resources development can provide a lens regarding how emerging cities might shape alternative urban water development pathways in the future. By developing a holistic and long-term view of the patterns of change within a highly interconnected water system, with a particular focus on urban water governance, we gain a better understanding for the scope of future governance strategies required to deliver sustainable urban water development.

Bangladesh is a valuable case to explore the evolution of urban water governance for it is undergoing rapid urbanization processes, with an estimated total urban population of 38 million (including 7 million living in informal settings) (UNICEF, 2010). Although urbanization brought significant economic progress, there has been little attention paid towards understanding the urban and urban sustainability-related phenomena (Rana, 2011; SACOSAN-VI, 2016). Within Bangladesh, there has been a significant emphasis on advancing agricultural developments, which relies on water resource management as a core driver of development; yet, urban areas still lack comprehensive access to clean water and sanitation facilities, including Dhaka. According to the Joint Monitoring Programme of the World Health Organisation (WHO) and UNICEF, access to improved drinking water sources in urban areas of Bangladesh has declined from 88% (1990) to 85% (2008) and only 8.5% of households have access to improved sanitation facilities, compared to a national claim of around 54% (MICS, 2009). Although Bangladesh has received global recognition for achieving progress towards the Millennium Development Goals in health improvement via increasing access to water and sanitation services (SACOSAN-VI, 2016), questions remain regarding the sustainability of such achievements and what levels of (adaptive) capacity have been developed over this period to deal with increasingly complex challenges associated with urban water systems. To date, the Bangladeshi urban water management system has been examined by a limited number of scholars, who have typically focused on individual sub-sectors: water supply (Bakker et al., 2008; Moinuddin, 2010), peri-urban water and sanitation (Allen, Dávila, & Hofmann, 2006; Hossain, Weng, & Mokhtar, 2012), water resource management (Hossain et al., 2012) and flood management (Brammer, 2010; Gupta, Babel, Albert, & Mark, 2005). Although there has long been an emphasis on flood management, this has primarily focused on rural settings (see e.g. Brammer, 2010). Collectively, these studies have examined institutional changes over time; however, few have explored the multiple scale interactions driving change explicitly for key urban areas (e.g. the capital city, Dhaka).

Against this background, this paper presents a detailed analysis of five dominant governance patterns beginning when a formal
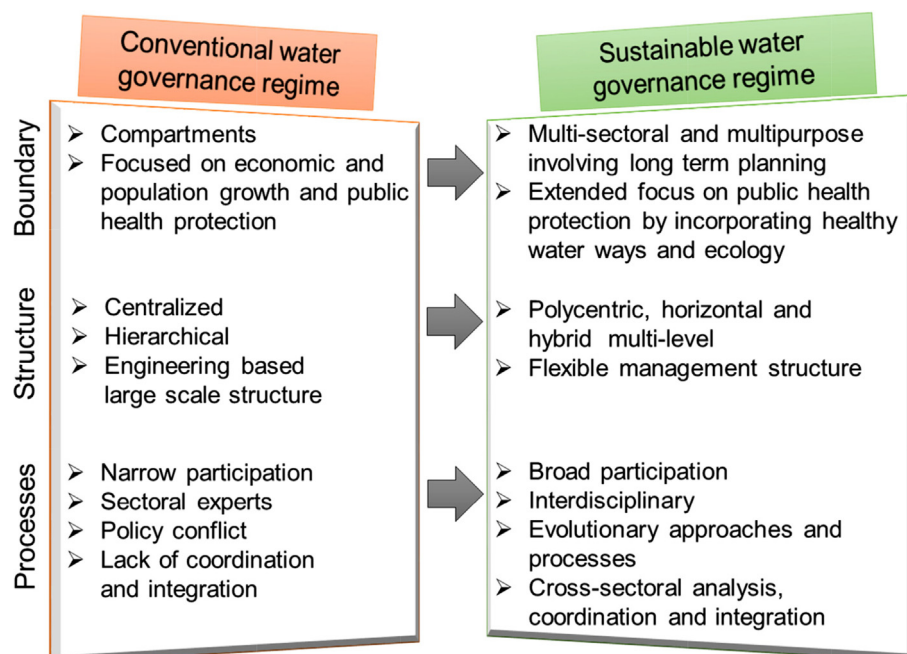
Fig. 1. Attributes of conventional and sustainable urban water regime. Adapted from Brown et al. (2009), Keath and Brown (2009), Pahl-Wostl, Holtz, Kastens, and Knieper (2010)
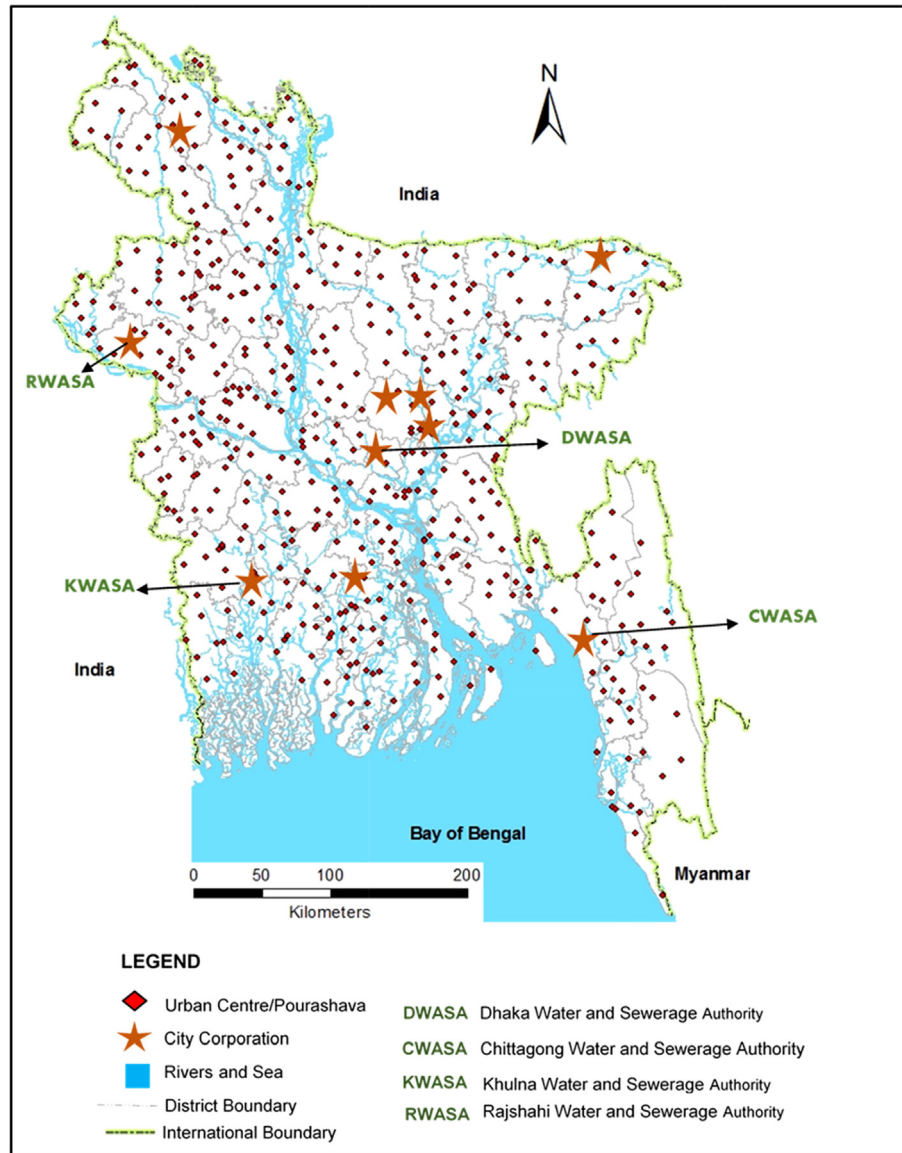
Fig. 2. Existing water and sewerage management authorities in Bangladesh (map produced by author).

urban water system was established during British colonial rule (1757 to 1947) and tracing the evolution of the urban water system through until 2016. Each of the five periods builds a nuanced understanding of the key characteristics, gaps and lessons learned from deploying diverse governance strategies and approaches for guiding urban water sustainability transformations in Bangladesh and other developing countries.

2. Water management (regime) transformation: background and theories

A water management regime is defined by Pahl-Wostl (2007, p. 54) as a 'whole complex of technologies, institutions, environmental factors and paradigms that are highly interconnected and together form the basis for the functioning of the management system targeted to fulfil a societal function'. Thus, transforming a water management regime requires an understanding of the relevant actors' roles and responsibilities, their interdependencies, and how the institutional arrangements support or constrain new practices (e.g. Holtz, Brugnach, & Pahl-Wostl, 2008). In the context of

this research, the water management regime consists of all relevant actors and institutions, networks and systems that are directly involved in shaping or evolving urban water systems in Bangladesh. Therefore, management and governance are interchangeably used within this paper, for management is considered an integral part of governance.

Understanding regimes and regime transformation is well captured within the sustainability transitions scholarship. This body of work offers a variety of tools and frameworks that provide insight into different system change processes through examining historical and contemporary socio-technical practices across scales in a number of different sectors including water, waste and electricity (Raven & Geels, 2010) and agriculture (Pant, 2016). The multi-level perspective (MLP) is a widely used framework which examines the dynamics of change processes and complex interplay among actors, institutions, scales, rules and activities across multiple scales of interactions both within and outside the socio-technical system, which collectively work to reinforce and drive a transition (Berkhout, Verbong, Wieczorek, Raven, Lebel, & Bai, 2010; Rip & Kemp, 1998; Rotmans, Kemp, & Van Asselt, 2001; Meadowcroft, 2005; Lawhon & Murphy, 2011). The MLP comprises

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three analytical scales in a nested hierarchy: landscape, regime and niche (Geels, 2005, 2006), each representing a heuristic to understand the diversity in actors and institutions that are connected though different roles, times and space which collectively define or redefine transformation processes (Geels 2006; Loorbach, 2007). Niches form to act as 'protected spaces' (e.g. specific markets or application domains) where individual actors, alternative technologies and local practices that deviate from the status quo manifest themselves as new ideas, initiatives or innovative techniques (Kemp, Parto, & Gibson, 2005). Detailed studies of the transformative potential of niches have been growing, guided by strategic niche management (SNM) analyses (see e.g. Raven, Kern, Smith, Jacobsson, & Verhees, 2016; Raven & Geels, 2010; Smith & Raven, 2012). Lawhon and Murphy (2011, p. 357) suggest that what occurs within niches is very much related to the other levels (regime and landscape), but distinct given the uniqueness and scale of the 'experiments' that go on within them.' The 'regimes' are typically more prevalent and stable, consisting of dominant, rigid patterns of institutions, physical and material infrastructures, routines, actor-networks, power relationships and regulations (Berkhout et al., 2010). The regime structure guides decision-making and individual actor behaviours (Geels, 2002) to perform economic and social activities which are interrelated with niches. Finally, the 'landscape' represents broad societal, climatic, economic and political trends, among others. Change at the landscape scale is relatively slow, with natural disasters being an exception (Van der Brugge & Rotmans, 2007). Of note, Lawhon and Murphy (2011, p. 358) suggest the landscape scale should not be 'viewed simply as a material 'container' for regimes and niches' (Lawhon & Murphy, 2011, p. 358), but an mechanism to account for factors beyond the niche and regime which exert pressure and drive a change in practices.

Although sustainability transition scholars emphasise the niche dynamics where innovation occurs and new sets of rules and patterns develop (see e.g. Geels & Raven, 2006), regime contexts are also receiving increasing scholarly attention in relation to their organizing activities and structuring forces across different actors groups and networks (i.e. public authorities, civil societies, end-users, researchers etc.) (Lawhon & Murphy, 2011; van de Poel, 2000). The activities and structures by actors and networks associated with institutions, practices and landscape factors developed a shared understanding of priorities, necessary actions and rules to governing the regime to a more stable state and support only the incremental innovations meaning locking in to a particular trajectory. However, if there are intra-regime or external factors those can contribute to instability or tensions among these actors and networks, the system can destabilize and open up opportunities for innovations those might occurred within niches (van de Poel, 2000). Analysing these dynamics between niche-regime-landscape developed our understanding on the processes of institutionalizations/ destabilization of the institutions those currently shaping the transition pathways. Collectively, the MLP framework assists in understanding scalar relations among and between different actors, organizations and policies involved in managing natural resources, such as water. In addition, Loorbach and Rotmans (2010) argue the framework can also be used as a theoretical tool for understanding how successful innovations can upscale to achieve governance goals. Although the MLP was primarily derived based on empirical cases from industrialised countries, a growing number of scholars have begun to apply the framework to examine sustainability shifts within developing countries (see e.g. Bai, Wieczorek, Kaneko, Lisson, & Contreras, 2009; Nastar, 2014; Pant, 2016; Wieczorek, 2017). Given its explicit aim of providing insight into the multi-scale dynamics that drive system change, the MLP offers a valuable tool for structuring analysis of data to support the characterization of historical change patterns for urban water development in Bangladesh.

3. Research approach

Bangladesh faces significant challenges related to rapid and unplanned urbanization, particularly around supplying appropriate water and sanitation services to these growing populations (SACOSAN-VI, 2016). It is therefore valuable to examine how historical and contemporary urban water management practices within Bangladesh have evolved in order to reveal pathways forward for achieving more sustainable urban water management into the future. Although Bangladesh is a jurisdictionally young country, there has been a long history of colonial development and foreign influence and investment in water systems. Over time, the different socio-political contexts within the Bangladeshi governance regime has witnessed the influence of different actors and institutions. This paper represents the first part of a broader investigation regarding opportunities for transforming the governance of Bangladesh's urban water regimes. Its major objective is to unpack the historical and contemporary development of water governance within Bangladesh with a key focus on the evolution of urban water management infrastructure, management and policies.

The Bangladesh Bureau of Statistics (BBS, 2011) has classified all urban centres into four categories:

(i) The megacity (population more than 5 million which includes Dhaka as the only megacity in Bangladesh).
(ii) Statistical Metropolitan Areas (SMAs) (City Corporations and adjoining areas with urban characteristics which includes three cities: Chittagong (3.39 million), Khulna (1.34 million) and Rajshahi (0.7 million).
(iii) Pourashava (currently 209 urban centres mostly at the district and sub-district scale as declared by local government authorities).
(iv) Other urban areas (sub-district headquarters and significant market places within rural boundaries that have sealed roads, good infrastructure services (e.g. communication, electricity, gas, water and sewerage) and a higher density of population in non-agricultural occupations.

Across these urban areas, there are currently four water supply and sewerage authorities (WASA) (one in the megacity and three in SMAs) which work with City Corporations in managing urban water, while the City Corporations and Pourashavas serve the remaining areas (Fig. 2).

The multi-level perspective (MLP) framework provides a useful heuristic for developing a comprehensive understanding of the interactions among critical components of urban water governance systems (Geels, 2005). This research examines the multi-scale dynamics and relations among diverse actor groups, networks and institutions to characterize the overall patterns of stabilization and de-stabilization of urban water development in Bangladesh. Key questions were developed to guide data collection and inform analysis of the niche-regime-landscape dynamics, which underpinned the changes over time in the formalization of urban water governance in Bangladesh over the period between 1757 and 2016 (see Table 1).

Historical analyses begins in 1757, when British colonial rule instituted the first 'formalised' urban water systems in Bangladesh (Sheesh, 2011). Extensive secondary documentary and media analysis was undertaken alongside 17 oral histories, which involved face-to-face interviews with key informants who have lived through different social, historical and political periods and

Table 1
Structured questions to guide data collection for analysis with the MLP framework.

Scales	Guiding questions
Landscape	i. *What pressures (internal and external) influenced Bangladeshi water resource management interventions?* ii. *What types of drivers or barriers were responsible for creating such pressures in Bangladesh's water sector?* iii. *What are the relationships between pressures, drivers, and barriers in the context of urban water management in Bangladesh?*
Regime	i. *What are the management strategies, guiding principles, and approaches towards governance interventions in the water sector?* ii. *How have these management strategies, guiding principles and approaches influenced urban water management?* iii. *What changes occurred in urban water management due to such interventions?*
Niche	i. *What key activities/changes occurred in Bangladesh's urban water sector?* ii. *How well have the different niches informed and created change?*

Table 2
Data collection methods.

Data	Methods	Sources	Dimensions
Primary Data	**Oral History (n=17)**	Across different organizations involved in water management, including academic (n=4), national level consultant (n=3), government professional (n=5) and NGO professional (n=5)	Retired and higher level (Directorate/Sectoral experts) Government officials, higher level authority in NGOs, policy activist and professors
	Media Analysis (1878 to 2016)	Monash Library web portal - South Asian Newspaper Archives - ProQuest Historical Newspapers: The Guardian and The Observer - Dhaka Tribune National Newspaper (Bangladesh) - The Daily star - Prothom Alo - Daily Ittefaq Available online news searching with the key terms in google.com.bd	Key terms for online news search: Water, Dacca*, Bengal, Sanitation, Cholera, East Pakistan, Canal Dispute, River, Water pollution Urban water, Bangladesh, Water management, Water supply, WASA, Dhaka Pourashava/ Municipalities
Secondary Data		Policy materials and national reports; organizational literature (i.e. government agencies and peak industry reports); industry and professional association literature and scientific literature	For example: Bangladesh Water Act, 2013; Bangladesh National Water Management Plan, 2004; Bangladesh National Hygiene Baseline survey, 2014; National Sustainable Development strategies, 2013; DWASA Annual reports; DPHE secondary city development project reports; Bangladesh Government fifth years plans etc.

* *Before 1982 Dhaka, the capital of Bangladesh spelled as 'Dacca'*

observed major changes in urban water management (see Table 2). Interviewees have worked within or studied the Bangladesh urban water sector for at least the last 18 years, with seven individuals each having more than 30 years' experience in the water sector. Interviewees were identified by examining industry literature, media analysis and the snowballing technique of peer recommendations (Creswell, 2013). Table 2 outlines the different affiliations and employment status of interviewees. Each interview was audio-recorded and transcribed for analysis. Interview questions explored the informants' involvement with the water industry; their perceptions of water management priorities and how these have changed over time; what drove or inhibited those changes; experiences with collaborative management and participatory approaches; and finally the strengths and weaknesses of the contemporary water management system. To build a robust narrative regarding Bangladesh's urban water development trajectory,

extensive secondary data sources were analysed, including digitised newspaper archives and policy documentation to test themes and patterns emerging from the interviews (see Table 2).

Media content analysis of primarily newspaper articles, assisted with capturing insights and reflections on key events, which ultimately helped frame the temporal discourse. Newspaper articles were a useful source of historical and contemporary activities and events for they reflect popular opinion and generate a more generalized picture of key issues (Pérez-Latre et al., 2011). Newspaper articles from 1878 to 2016 were collated from an online-digitised repository hosted by Monash University, and sorted by specific search terms (see Table 2). The articles were arranged chronologically to generate a timeline of key urban water developments within Bangladesh's water sector and articles were reviewed to identify key actors, management approaches and emerging technologies related to urban water development.

Drawing on the conceptual framing of the MLP, the analysis of primary data focused on institutional changes over time, technological advancements, key stakeholders and processes contributing towards changes, evidence of network developments, description of collaborative initiatives, general public opinion, priorities, visions and goals, political motivations and external influences. Primary and secondary data were collectively analysed for their convergence and divergence, and systematically reduced into thematic and descriptive content (Creswell, 2013). This was completed over two phases. The first phase established a chronology of water resource developments; with a key focus on urban spaces to identify, distinct time-periods that were based on dominate governance approaches within the evolving socio-political systems. The second analysis phase examined each distinct time-period to identify the landscape pressures, explain how the regime changed in response to these pressures and how these changes provided a platform (or otherwise) for niche development. The objective of looking at multiple scale interactions was to capture the overall patterns of change and urban development pathways, as well examine the role of actors and institutions within the regime and niche development.

4. Results: urban water development in Bangladesh (1757–2016)

The evolution of urban water development in Bangladesh largely centres around Dhaka as the capital city; however, this research also incorporates evidence regarding other city corporations and municipalities (medium and small cities). Prior to British Colonial rule, subcontinental communities relied on (i) wells, ponds and surface water for drinking and household activities; (ii) natural drainage channels for flood protection; and (iii) individual responsibility for water security and sanitation, although there was typically support from the local community or an administrative unit responsible for particular urban areas (Sheesh, 2011).

The analysis revealed five major shifts since the pre-colonial era, each with a distinctive governance pattern. Once British colonial rule was established in 1757, the translation of European urban water technologies and management approaches to the subcontinental context began. In summary, there was an initial period of translation of European urban water technologies and management approaches to the Bangladesh context (1757–1947). This was followed by a shift towards strategic planning and recognition of the need to work across sectors rather than in silos (i.e. water supply, drainage, sanitation etc.) (1948–1971 & 1972–1995). Participatory approaches then became key to engaging with the communities of practice and encouraging management initiatives including civil society (1996–2005). Finally, a pressing need to address complexity and embed sustainability through adaptive management became apparent (2006–2016). Each of these distinct periods is outlined in the following sections, along with their key landscape, regime and niche scales of governance activities. Tables 3 and 4 summarise the changes present in both system (Table 3) and service levels (Table 4) and collectively reveal the growing complexity in the number of new-in-context technologies (niche) applied and regime responses underpinning the evolution of Bangladesh's contemporary urban water system. In addition, Table 5 presents the increasing complexity in actor clusters and governance activities over this time period.

4.1. System Initiation and development (1757 to 1947)

The introduction of formal water supply and sanitation (WSS) systems (Dacca waterworks) in 1878 by the British (colonial period 1757 to 1947) marked the first 'formalization' of urban water management within Bangladesh. Although British rule on the subcontinent began in 1757, it took close to a century to formalize the urban water system. Colonial powers within the Indian Subcontinent responded to direct pressures from England to deliver a formal WSS system, which led to the evolution of a water management regime that incorporated piped water networks with treatment plants, a small number of strategically located public toilets and minor drainage (stormwater and sewage disposal) schemes. International pressure from the British Government was largely driven by two factors: (i) concern about the health of the visiting British prince (including the health of British army and citizens), and (ii) the fundamental right of subcontinental peoples under British rule to expect similar basic WSS services (Harrison, 1994). As identified by the Sanitary Governor of Bengal province, and reported in the Amrita Bazar Partika newspaper (dated 1904):

> Cholera had made its permanent home in this country. We also know that good drinking water puts a check upon the growth of this red disease. In Bengal, the people are thus in very much in need of good drinking water to save their lives.

In response, an urban water niche began to emerge; focusing on new-in-context approaches to water supply (the beginnings of a street-scale piped-network) and sanitation works (drainage system and public toilets). Water supply and sanitation was the primary concern, driven by increasing public health crises and the government was keen to build a system within major urban centres to provide hygienic water and sanitation services, first to British citizens (who had migrated for business or governing purposes) and a few 'native-elites' (Kooy & Bakker, 2008).

Between 1871 and 1947, municipalities within the Indian Subcontinent region (which straddled the niche and emerging regime level) were assigned sole responsibility for providing water and sanitation services through a number of legislative acts (Khan, 1997). To implement and fund these services, the colonial powers required municipalities to collect taxes for infrastucture provision, but this never received public support and was subsequently substituted by a fee-for-service for house-owners (Sheesh, 2011). By the middle of the 20th century, an increased demand for piped water supply from the public led municipalities to expand and augment the supply network, which required further financial and management capacity. Responding to this demand, regime actors (colonial government, provincial governors) expanded regime activities through several strategies as reported in newspaper articles between 1890 and 1950: (i) a loan scheme established by the state to support additional infrastructure developments; (ii) promoting the rise of professionalism (primarily engineers); (iii) establishing a state sanitation commission; and (iv) introducing a system for receiving feedback about water service improvements (context specific approaches for water supply). Collectively, these strategies led to the development of the nascent urban water regime, and although media reports at the time presented a generalized picture of subcontinental urban water systems, Dhaka was mentioned numerous times due its economic and political importance throughout British rule.

During this period, the technocratic emphasis was largely on water supply; however, flooding events significantly challenged the ability of regime actors to deliver quality urban water services. Reacting to this situation, the British colonial authority expanded its focus to incorporate flood control measures (i.e. embankments and channelization of rivers) (Rahman, Haque, Khan, Salehin, & Bala, 2005). This led to a reduced impetus (e.g. investments) for sanitation facilities (e.g. public toilets and sewerage drains) and consequently led to a shift in responsibility for sanitation services from the state government to municipalities. However, localised

Table 3
Landscape pressures and regime responses in managing Bangladesh's urban water system from 1757 to 2016.

Periods of development	System Initiation and Development Era (1757-1947)	Planning for Water Resource Development Era ((1948-1971)	Sectoral Interconnection and Joint Initiatives (1972-1995)	Introducing IWRM & MDGs (1996-2005)	Complexity and Sustainability (2006-2016)
SOCIO-POLITICAL CONTEXT	**BRITISH COLONY**	**PART OF PAKISTAN**	**BANGLADESH**		
LANDSCAPE	Public health				
			Increasing urban population		
			Poverty reduction		
				Broader economic pressure	
				Environmentalism	
					Adaptation strategies
					Sustainable Development Goals
REGIME VISION AND APPROACHES	- Engineering based-solution - Sector specific interventions	- Engineering-dominated - International multilateral organizations assistance - Long-term planning - Multi-purpose projects aiming towards integrating water and energy	- Rehabilitation and economic stability - Sectoral interconnections - Joint management initiatives	- Economic growth - Environmental stability - Integrated Water Resource Management - Participatory learning	- Develop sustainable and adaptive pathways to climate change and disasters and focus on the sustainable use of natural resources. - Mainstreaming adaptation in national planning and implementation guidelines - Establishing Government and NGOs partnership for development projects - Industry partnerships - Three strategic time-frames for development project (short-term, medium-term, and long-term)

drivers for embracing piped sanitation services were largely absent, since social and cultural norms regarded in-home toileting as inappropriate and the Bengal region had sufficient precipitation and water channels to flush sewage into the rivers (SDP, 2005). This socio-cultural position favoured open defecation practices resulting in municipalities' (regime actor) unwillingness to install further sanitation facilities. Additionally, other challenges constraining the implementation of further sanitation works included (i) insufficient financial incentives for municipalities to provide sanitation services over piped-water supply requirements and (ii) a lack of professional capacity for servicing and maintaining the infrastructure requirements (Harrison, 1994; Sheesh, 2011).

While municipalities were solely responsible for water and sanitation services, few formal accountabilities were established, resulting in mismanagement and misuse of funds (Rabbani, 2011; Sheesh, 2011). This was repeatedly identified within media reports, highlighting delays in implementing urban water works due to a lack of internal capacity and leadership. For example, an article from Amrita Bazar Patrika newspaper dated 20th August 1916, stated:

Dhaka spent practically nothing in 1913–1914, the percentage being only 3. But the following year it spent more than half of the money at its disposal namely 53.6%. There was however, no other Board, which spent more than 44%. And no wonder that tens of million, as before piteously cried for drinking water during the last four years in the months of March, April and May and got only what was more like diluted sewage than anything else. These boards have their resolution but Government never call for answers for not accomplishing their resolutions.

In response to this persistent challenge, the government established another regime actor, the state Department of Public Health and Engineering (DPHE), to monitor and guide the municipality's water works. By the end of the British rule (1953), DPHE assumed full responsibility for urban water systems in Bangladesh and became the dominant regime actor. This marked a shift to a centralised administrative bureaucracy by the colonial power, built around traditional centralised, linear engineering approaches, similar to urban water developments within European countries. This European model was adopted by many cities around the world during this period (Brown et al., 2009).

4.2. Planning for water resource development (1948 to 1971)

By 1948, the colonial authority withdrew and Bangladesh became East Pakistan (1948 to 1971). During this time, water governance approaches shifted to align with the emerging socio-political priorities and visions for securing transboundary river water flows for agricultural productions (see Table 4). Alongside the political shifts, major exogenous events occurred, primarily recurrent large-scale floods (1954, 1955 and 1956) that led to famine-like conditions across Bangladesh. This situation led to a regime shift away from immediate concerns for sanitation and public health, towards the national priority of developing irrigation and drainage systems aimed at ensuring food security (as reported in articles in the *Times of India* newspaper from 1951 to 1970). As identified by an interviewee:

That time we were not thinking about water supply and sanitation, only trying to explore cheaper irrigation technology for increasing

Table 4
Landscape pressures and regime-niche responses within Bangladesh's urban water services sector from 1757 to 2016.

Periods of development		System Initiation and Development Era (1757-1947)	Planning for Water Resource Development Era (1948-1971)	Sectoral Inter-connections and Joint Initiatives (1972-1995)	Introducing IWRM & MDGs (1996-2005)	Complexity and Sustainability (2006-2016)
Socio-political context		*British colony*	*Part of Pakistan*	*Bangladesh*		
Service level — **Water supply** — Landscape		Colonial authority expected to ensure fundamental rights to clean water.				
				Drinking water quality	Water quality and quantity	Water security
				Surface water pollution	Ground and surface water pollution	
					Milllennium Development Goals	
Regime vision and approaches		- Reduce mortality rate from cholera outbreak by providing good quality drinking water. - Municipal driven water works (water supply as first priority).	- Reduce child mortality rates related to cholera and diarrhoea outbreaks. - Prevent death due to lack of access to drinking water. - Increase coverage and access to drinking water sources.	- Increase access to safe drinking water. - Develop groundwater resources for irrigation (food security) and drinking water.	- To achieve 100% access to safe drinking water by 2011. - Decentralization of the administartive and supply system. - Create a baseline database for improvements in accessing drinking water.	- Provide safe water coverage throughout the country by 2015. - Minimize groundwater depletion. - Develop alternative technologies and approaches. - Support local scale comprehensive plan development.
Key niche* activities		Surface-water based water supply system involved applying new-in-context technologies: piped-networks, treatment plants, street hydrants, overhead and steel tanks for water storage, and reserve ponds/wells.	Responding to external regime actors, groundwater-based piped water supply technologies included: production tube-wells and shallow-hand tube-wells.	Breadth of groundwater-based piped water supply technologies expanded to include tube-well water supply systems and chlorine cylinders for purification. - Drinking water quality improvements within informal settlements led by NGO activities driving small-scale water supply systems.	Groundwater-based piped water supply persists, but WASA-based projects shifted their focus towards improving water quality and ensuring quantity through different novel techniques. - Actions by DPHE lead to digital platforms for monitoring activities.	Renewed interest in surface-based water systems involves applying rainwater harvesting and reserve pond approaches, while groundwater based technologies persist. - Sanitation programs grow in prominence due to NGO networks (e.g. Bangladesh WASH alliance; Bangladesh Water Integrity Network).
Sanitation — Landscape				Rural public health		
				Milllennium Development Goals		
				Sewerage system management		Human waste management
Regime vision and approaches		- Municipal driven waterworks (sanitation a second priority as British Government focuses on drinking water supply as first priority).		-Increasing access to sanitation services.	- To achieve 100% access to sanitation services by 2013. - Decentralization of the water management administrative system. - Established baseline database to monitor sanitation delivery progress.	- Provide full sanitation throughout the country by 2015. - Encourage uptake of alternative technologies. - Support local-scale comprehensive plan development.
Key niche* activities		- Drains for diverting rainwater to rivers and reducing impact of urban flooding.	- Septic tank roll out (primarily households). - Combined drainage schemes for sewerage and stormwater management.	- Underground domestic sewerage drains. - Box culvert technology for combined drainage system. - Increasing number of separate drains for stormwater. - NGO-led sanitation activities at community/ household levels.	- Four types of state-led latrine installations (individual, school, community and public). - River restoration projects and sewerage dumping stations. - Community-led total sanitation programs led by NGOs.	- Hatirzhell water retention project, Dhaka. - Increasing NGO initiatives and broadening actor-networks. - Bangladesh WASH alliance. - NGO-led pit and pit-pour-flush latrine installations. - Pilot project for faecal sludge management improvements.
Flood control/ Drainage — Landscape		Protection from regular inundation	Flood control	Flood management	Disaster management and climate change adaptation	
				Food security		
				Transboundary river issues		
Regime vision and approaches		- Reduce flood impact by building embankments and channelizing rivers. - Build embankments/ dams to control flood.	- Prevent death associated with starvation (limited water for agriculture). - Protect property and agricultural products from flood. - Establish irrigation system for increasing agricultural productivity.	- Aim is to *manage* floods rather than *control* floods. - Support to develop Flood Action Plans.	- Integrated and participatory resource management.	- Develop sustainable and adaptive pathways to mitigate against climate change and natural disasters. - Focus on the sustainable use of natural resources.
Key niche* activities		- Embankments/Dams for flood protection. - Hydro-electric power plants - River navigation systems	- Flood control projects - Hydroelectric power plants	- Separate drains for storm water management.	- River restoration projects - Restoration of canals and wetlands to improve urban drainage. - River basin management - Tidal basin management	- Hatirzhell water retention project, Dhaka - Bangladesh Delta Plan, 2100

Key niche refers to the activities in cumulative manner those were new-in-context within the specific eras and might become part of regime in later eras.

our rice cultivation aiming towards rural development. [Interviewee 5]

To achieve this political vision, government agencies sought international support from organizations such as the World Bank and UN organizations.

Up to this point, traditional water management approaches in Bangladesh were characterized by short-term and ad hoc solutions (Table 4). However, following recommendations by international organizations representing a UN technical assistance team (known as Krug mission), this period witnessed the introduction of long-term planning as a tool for water sector development. Indeed, by

1964, Bangladesh had its first 20-year plan for water resource management as a direct outcome of the recommendations by the Krug mission report and an International Engineering Company Inc. (IECO) coordination and consultation report (Brammer, 2004). Notably, this long-term plan did not directly include water supply and sanitation within water resource management; however, it did establish an individual organization, the Water Supply and Sewerage Authority (WASA) as a regime actor to secure urban water supplies.

The first WASA was established in Dhaka in 1963 and the second WASA in Chittagong in 1968 under the national authority, the Local Government Engineering Department (LGED) (regime actor). Beyond these two WASAs, municipalities under the jurisdiction of DPHE served the remaining urban areas. As the WASAs were created through this long-term planning process they received greater technical and financial guidance from international donor organizations, and their capacity for managing water supply was far greater when compared to local scale municipalities (see e.g. Rabbani, 2011). Similarly, within the context of mitigating floods, water resource management was dominated by international donor agencies, which aimed to foster public agency responsibility for developing drainage schemes to introduce irrigation systems for agricultural productivity. This shifted the regime's focus away from urban servicing towards unified and coordinated water and power development, and established the East Pakistan Water and Power Development Board (EPWPDB) as another regime actor responsible for developing hydroelectric projects, irrigation and drainage schemes.

International multilateral organizations (i.e. World Bank and USAID), regarded here as external regime actors (as they are not directly involved in implementation), assisted WASAs' activities. The principal focus of these external regime actors was on advancing economic development in Dhaka, despite other regions of Bangladesh facing a severe drinking water crisis and deficiencies in basic sanitation. Responding to the statewide drinking water crisis (1970), the Government began to distribute shallow hand tube-wells at no cost, which opened the window for niche growth around this technology. Development around this niche was an outcome of the World Bank and USAID's recommendation to utilize the abundant groundwater resources to reduce mortality related to frequent diarrheal outbreaks from drinking contaminated water (SDP, 2005). Once again, sanitation services did not receive the same level of government atttention as securing water supplies. Nevertheless, the WASAs did develop combined drainage systems (originally initiated by the British); however, these systems did not expand due to financial and technical limitations (SDP-WSS, 2010). In the absence of regime-led advances in sanitation services, individuals and households began to foster niche activities that were largely informal and aimed at developing on-site sanitation systems, such as septic tanks and hanging latrines. Building on these early private initiatives regarding urban sanitation, the broader roll out of septic tank sanitation became a popular alternative to large-scale drainage schemes due to its feasibility and reduced costs (SACOSAN-VI, 2016).

The media analysis from 1948 to 1971 revealed limited coverage regarding the development of the urban water supply and sanitation sector. During this time, regional river water-sharing disputes and political instability were the primary focus of the print media. One minor exception revealed media reports on new hydroelectric plants for Dhaka and Chittagong, which were water supply initiatives established under the 'Multi-Purpose' project by the state aiming to integrate water and energy sector developments. In addition, coverage of floods and other natural hazards received media attention, particularly focusing on the scale of damage to people's lives and properties.

4.3. Sectoral interconnection and joint initiatives (1972 to 1995)

Upon achieving independence from Pakistan in December 1971, Bangladesh faced numerous challenges, including the pressure of addressing conditions of widespread poverty. This additional landscape pressure directed regime approaches towards activities that provided economic stability, whilst protecting against flood damage. The influence of donor organizations (development banks) continued to provide resources for national and international studies, and further to identify necessary strategies for addressing water security by drawing on the perceived abundance of groundwater resources for irrigation and drinking water purposes. The recommendation to utilize groundwater resources was the outcome of a report by the International Bank for Reconstruction and Development (IBRD) (1972), although the Government did not consider the overall report due to a number of contradictory conditions imposed by the IBRD (SDP, 2015). This led to a groundwater-dominated water management regime, and the abundance of groundwater opened a window for developing water supply-focused niches rather than innovation in sanitation. Indeed, it was anticipated that by introducing groundwater as a key source for irrigation and safe drinking water supply, this would lead to improved food security and contribute towards addressing public health threats by reducing diarrhoea and cholera outbreaks (Gupta et al., 2005).

Building on the growing experience of the water management regime in relation to addressing flood conditions, numerous donor organizations saw potential to leverage this knowledge and begin a process of comprehensive flood action planning across Bangladesh. As a result, Flood Action Plans (FAPs) (1989–95) were developed and implemented across Bangladesh, and were subsequently heralded as one of the largest innovations in the country's water sector of the time (Brammer, 2010; Sultana, Thompson, & Green, 2008). Attracting significant investment, the FAP process aimed to bring together key actors, fostered sectoral interconnections, and the development of joint (national and international) initiatives, instead it supported infrastructure-based niches in flood management (e.g. constructed dams/dykes and embankments all over the country) (Brammer, 2004). However, the FAPs largely failed to achieve the anticipated outcomes due to a lack of meaningful and relevant stakeholder participation (Brammer, 2010; Sultana et al., 2008). These failures led to the development of participatory guidelines by the government, which became instrumental for water management in Bangladesh and provided explicit opportunities for including citizen voices (Sultana et al., 2008).

While state actors focussed on FAPs implementation for flood mitigation, improving water supply and sanitation largely aimed on installing tube-wells across the country. Interviewees also noted pressures at this time to reduce national child mortality, which further prompted the use of tube-wells for improving water supply, with key focus on small rural town areas. While state agencies continued to focus on developing Dhaka and a small number of secondary cities, NGOs focused on developing water and sanitation facilities for the rapidly growing informal settlements (slums) (SDP, 2005). Government agencies and NGOs both adopted tube-wells as the dominant water supply technology for it was cheap and easy to maintain. However, sanitation practices still did not receive government attention and remained the domain of private initiatives (as onsite sanitation systems) and in a small number at the community level. For some time, the NGO-led initiatives for improving drinking water access across Bangladesh (SACOSAN-VI, 2016) were successful, but in 1993 arsenic groundwater contamination was detected in 53 of Bangladesh's 64 districts. This contamination was broadly reported in the media and ultimately constrained water supply advancements.

Table 5
Change over time (1757 to 2016) in the governance agenda and actor clusters influencing Bangladesh urban water governance.

Socio-political context	Period of Development	Key policies and plans	Shifts in governance agenda and key actor-clusters	
British colony	*System Initiation and Development Era (1757-1947)*	- Bengal Municipalities Act (1864, 1938) - Local Self-Government Act (1885) - Local Government Loan Act, (1879) - The Drainage Act (1880)	State-led (top-down) agencies (DPHE) alongside the formalisation of municipalities led to the development of a linear urban water system guided by sectoral experts (primarily engineers) with a focus on drainage and flood mitigation.	State → Citizens
Part of Pakistan	*Planning for Water Resource Development Era (1948-1971)*	- Krug Mission Report - 20-year master plan	Following significant growth in the influence and investment of external donors (World Bank, UN organisations etc.), State-led formal water systems formed Water supply and sewerage authorities.	Donor organizations; State → Citizens
Bangladesh	*Sectoral interconnection and joint initiatives era (1972-1995)*	- Drinking Water Standards (1984) - Participatory Guidelines for water based projects (1995,1998, 2000)	Ongoing growth in external donor influence and investment continued to shape State-led formal urban water systems. However, during this period there was an emerging service delivery role for NGOs around water supply and sanitation, which subsequently increased opportunities (formal and informal) for citizen participation in decision-making.	Donor organizations; State → Citizens; NGOs
	Introducing IWRM & MDGs (1996-2005)	- National Water Policy (1999) - National Water Management Plan, (2004) - Upzilla & Zilla Parishad Act, (1998) - Water Supply & Sewerage Act, (1996) - National Policy for Drinking Water and Sanitation (1998) - Wetland Protection Act (2000) - Private Housing Development Rules (2004) - Water supply & sanitation baseline survey (2003) - National Sanitation and Hygiene Strategy (2005) - Water & Sanitation Sector Development Plan (2005-2015)	Maintaining the external influence of donors and NGOs encouraged significant policy shifts away from single water stream focus, towards embracing IWRM systems. This facilitated a growth in number of collaborations between state organisations (DPHE, WASAs etc.) and NGOs. NGOs' relationship with local communities in turn gave rise to stronger citizen engagement and enabled environmental activists to influence regime activities (e.g. wetland protections).	Donor organizations; State ↔ Citizens; NGOs; Environmental activists
	Complexity and Sustainability Era (2006-2016)	- Long-term Perspective Plan (2010-2021) - Sectoral Development Plans - Bangladesh Strategy for Climate Change Adaptation and Strategy Action Plan (2009) - Bangladesh Water Act (2013) - Public–Private Partnership Act (2010)	Cumulatively, the actor-networks clusters continue to grow in number and broaden and deepen in number (actors and organisations). IRWM remains a key driver but the emphasis has shifted towards encouraging sectoral adaptation and sustainable development within the water sector with a broader focus on addressing present and future climate change challenges. Multiple actor clusters, including non-state actors (including academics and private organisations) have a growing influence on niche-regime interactions.	Donor organizations; State ↔ Citizens; Environmental activists; NGOs; Other non-state actors; Civil society

Of note, the Dhaka WASA was not impacted by arsenic contamination and thus continued to improve its water supply coverage through investment in a number of innovative solutions. One example of the Dhaka WASA's achievements was formulating legal authorization for connecting slums to water supply servicing. Before 1993, there had been no legal water connection for slums due to their illegal establishment. However, health-related NGOs began negotiating with the WASA and, following several years of consultation, were able to generate a formalized statutory provision for water facilities in slums (e.g. Allen et al., 2006). Later, other WASAs replicated this statutory provision for slum developments in their own urban areas. Beyond Dhaka, Bangladesh's cities were still lacking basic infrastructure and human resources for sufficient water supply. In an effort to improve water quality, the Government, with support from the World Health Organization (WHO), established drinking water standards in 1984. Despite these standards, the limited management capacities of municipalities and WASAs meant targeted water quality standards were not met (SACOSAN-VI, 2016).

4.4. Introducing IWRM and MDGs (1996 to 2005)

Responding to the failures of the FAP processes, the Government established participatory guidelines in 1995 and revised these in 2000. The guidelines drove significant change within the water management regime. For example, they provided a voice to a broad range of stakeholders involved in water resources management, which subsequently drove the formation of self-organizing networks and ultimately built their capacity for supporting further innovation. In addition, community-based organizations (CBO), which advocated for formal water connections within slum areas, were also responsible for managing and collecting bills for the water service provided by the WASAs. As a result, the numerous water user groups and community-based organizations formed to generate 'bottom-up' strategies for water management (Sultana et al., 2008), which contributed towards strengthening the role of niche actors for facilitating demand driven approaches to water resource management. These predominantly local-scale groups encouraged participatory and bottom-up learning, and created a broader platform for accommodating significant institutional changes towards systematic planning and integration in water related service provision (e.g. National Water Management Plan, 2004, Women's involvement strategies in WRM, National Sanitation and Hygiene Strategies, 2005). According to many interviewees, this represented a significant shift within Bangladesh, and denoted significant steps towards establishing good governance practices.

Meanwhile, regime water management policy shifted towards Integrated Water Resource Management (IWRM) approaches, in an attempt to guide future water-related investment within Bangladesh (Nowreen, Khan, & Huq, 2011). The introduction of IWRM was considered a major breakthrough for Bangladesh's water management sector, which led to water supply and sanitation being incorporated into national planning processes for the first time, and informing relevant policy and legislation to guide water sector development (Gupta et al., 2005). However, interviewees suggested that significant issues were not considered within the institutional directives, including water allocation to multiple users, seasonal water variability and groundwater depletion [Interviewees 7 and 9]. Similarly, interviewees associated with policy

consultation and academia highlighted the challenges associated with IWRM in Bangladesh, for example:

Integrated water resource management is not happening in Bangladesh. In urban areas, we studied Khulna, and we know about Chittagong and Dhaka, and I was involved in many national and international studies in urban settings and realized that we are still managing our water resource by mon-sector development [Interviewee 1]

The adoption of IWRM in 1999 and the launch of the Millennium Development Goals (MGDs) in 2000 placed a strong emphasis on improving water supply and sanitation access across Bangladesh. Establishing baseline data in 2003, and conducting joint monitoring and evaluation with the UN were among many new approaches adopted by the Government to comply with achieving MDG targets (SDP-WSS, 2015). The Government initially set a target of "100% sanitation by 2010", which was later extended to 2013. To achieve this, the Government (i) created a national sanitation campaign; (ii) decentralized the administrative system; (iii) established water supply and sanitation sections and committees at different administrative levels; and (iv) increased funding allocations to local government institutions. Despite these advances and changes in governance regimes, they failed to translate to on-ground actions (Rouillard et al., 2014). This was a result of numerous, interconnected challenges. For example, there was (i) an overall decrease in water sector investment during this period (Gupta et al., 2005); (ii) institutional directives failed to recognize the complexity of the actor-networks involved in water governance; (iii) no clear or defined organizational responsibilities, which resulted in significant overlaps; and, (iv) insufficient guidance regarding funding allocations at lower adminstrative levels (Araral & Yu, 2010).

During this time-period, formal urban water and sanitation authorities continued to oversee advancements in water supply and sewerage facilities. Dhaka WASA adopted several initiatives following IWRM principles to improve water supply and sanitation, whereas an interviewee highlighted that Chittagong WASA only had facilities for water supply, and do not have any capacity or infrastructure for addressing sewage management. Most interviewees regarded the urban water and sanitation systems of this time to be '*very poor*' and lacked basic '*technology and skilled staff*' to manage the systems (Interviewee 1, 2 and 7, for example). In response to these service deficiencies NGOs (national and international) turned their attention towards fostering different approaches, most commonly the Community-Led Total Sanitation (CLTS) movement, based around pit latrine technology (UNICEF Bangladesh, 2015). Although this niche initially focused on rural areas, the efficiency of this approach further attracted many organizations for improving sanitation in urban slums (UNICEF Bangladesh, 2015; MICS, 2009). While the progress of state-led sanitation activities remained insignificant, NGOs (regime) and informal institutions (niche) remained key drivers in advancing the uptake of pit latrine technology, which contributed towards improving sanitation coverage throughout Bangladesh. Notably, sanitation coverage across Bangladesh increased from 33% in 2003 to 80% by 2009, reducing open defecation from 42% to 6% by 2009 (MICS, 2009). Further, a survey identified that NGOs were providing approximately 50% of all sanitation services across Bangladesh, and thus were becoming powerful lobbyists with capacities to influence government agencies (see e.g. Gauri & Galef, 2005). However, an absence of a formal regulatory system raised questions regarding the accountability of many of these organizations (Gupta et al., 2005).

Increased uptake of pit latrines and septic tanks generated positive outcomes in relation to public health, they were predominantly connected to open stormwater drains, resulting in sewage being directly conveyed into open water bodies. Thus, local rivers remained heavily polluted and reduced clean drinking water supplies. This issue became a key media topic during this period and ultimately resulted in widespread environmental activism and public protests aimed at creating change within water and sanitation approaches (i.e 'Buriganga Bachao Andolon'). In time, the Government responded by developing and encouraging the implementation of the Environmental Conservation Act (1995); however, there remained significant gaps related to its implementation and monitoring.

4.5. Complexity and sustainability (2006–2016)

Early within the 21st century, Bangladesh's water governance regime faced increasingly complex landscape-level pressures (see e.g. Table 3) for (i) greater economic development, (ii) improved environmental conditions and (iii) other socio-political phenomena collectively led to significant changes within the water regime. Interviewees identified several key characteristics that positively influenced this regime change. For example:

(i) a participatory and multi-disciplinary team (e.g. economists, social-scientists and engineers) drafted policy and management plans aimed at instigating bottom-up learning to prioritize local problems;

(ii) there were different strategic time-frames (long, medium and short) at play;

(iii) the Water Act (2013) was developed and enacted for supporting and integrating approaches for the development, management, abstraction, distribution, use, protection and conservation of national resources (BWA, 2013); and,

(iv) there was a shift towards decentralization of administrative systems towards the lowest implementation level.

Interviewees suggested the approaches were framed within the context of adaptive and integrated water management. Nevertheless, interviewees also highlighted the significant challenges inhibiting further progress including: failure to consider water quality issues; a lack of legal rights for individuals around water conflict; the Government as dominant actors in decision-making; and despite decentralization of the system, local level actors were excluded from decision-making processes (Gain and Schwab, 2012; Rouillard et al., 2014). Moreover, most of the interviewees noted the '*expiry of key institutional documents*' and lack of '*regular updates*' of key policies as critical for further progress in water resource management [Interviewees 2, 7, 8 and 16]. Additionally, interviewees highlighted political unwillingness, lack of accountability and transparency in government decision-making, and overall low trust in government policies and discourses as key reasons hampering progress, which are also reflected in other empirical studies on water governance (Araral & Yu, 2010; Bakker, 2009).

Yet despite these challenges, the Bangladesh water governance regime continued to focus on developing integrated and participatory aproaches to water resources management, and developed '*very promising*' policies and strategic direction documents according to intervew participants. However, these initiatives lacked the necessary institutional framing and driving forces to successfully translate to on-gound implementation. Interview participants suggested implementation could be improved by building consensus among stakeholders regarding context specific development interventions, and producing local-level implementation guidelines to support regime change or transformation towards sustainability. This 'context' debate in the water sector in Bangladesh has persisted for more than two decades, as reflected in the media coverage, and involves questioning whether basin-wide approaches, a

rural–urban development approach or long-term development projects are the most effective. For example, in 2015, the Government adopted the *Bangladesh Delta Plan 2100* (Bangladesh Delta Plan, 2015), supported by the Netherlands Government, which focuses on broader water resources development. Despite the Government's emphasis on a five-year strategic planning horizon to promote development agendas, the NGO and academic interviewees questioned the necessity of this 100-year planning timeframe. They suggested that extensive, long-term planning initiatives led to unclear implementation arrangements and a lack of direct engagement by relevant water authorities. Of note, the Government's economic planning division is currently leading the Bangladesh Delta Plan 2100, while the water resource planning organization remains absent. While questions remain regarding the suitability of large-scale projects like the *Bangladesh Delta Plan 2100*, the '*Water Safety Framework in Bangladesh*' has avoided such controversy and started as a small-scale project. This project, supported by the World Health Organisation (WHO), was implemented at local, niche scales and is designed to improve drinking water quality in response to MGD targets. This resulted in Bangladesh becoming one of the first countries to deliver water safety plans (WSPs). Implementation of these WSPs aimed at securing water supply and quality of drinking water from the supply source to the consumer level. With further support from WHO-AusAid, this program recently extended to a third phase (2012–2016). As of 2016, WSPs have been implemented within 15 municipalities, one City Corporation (Sylhet) and the Rajshahi WASA. These initiatives remain at an early stage of development and their contributions towards advancing more sustainable water governance practices in Bangladesh have not been thoroughly investigated.

Although more niches and regime developments have recently been observed than in previous eras within Bangladesh's water sector, the overall development appears uneven and unsustainable due to an absence of critical linkages for driving effective regime-niche interactions. According to the 2011 Sectoral Development Plan, piped water supply coverage was 83% for Dhaka, and only 40–50% coverage for other major cities and towns, with overall sanitation coverage in urban areas at 54% (SDP, 2011). Similarly, MDG monitoring revealed that Bangladesh has significantly improved water and sanitation services (SACOSAN-VI, 2016); nevertheless fewer than 50% of the population living outside the capital city are likely to receive adequate water and sanitation services. Several studies have suggested that only around one-third of connected households receive all-day water delivery (Hossain et al., 2012). Water demand in most peri-urban areas continues to be met via private pumps and hand-operated tube wells. Although some private developers often install sewerage and drainage facilities within their housing development projects, many others let sewage and stormwater flow into the surrounding low-lying land (Hossain et al., 2012). There are few opportunities for using alternative means of water supply due to arsenic contamination and ground water depletion (e.g. hand-pump tube-wells), and these are further vulnerable to contamination by the density of septic tanks and latrine pits in the populated urban centres (SDP, 2011). As a result, NGOs and civil society organizations are demanding context specific solutions to Bangladesh's water and sanitation problems, but existing literature and policy regimes show a lack of research into which approaches are likely to improve the situation. Of note, key industry reports and interviewees highlighted how the national Government was beginning to focus on improving water and sanitation services, including, for example:

(i) long-term planning for every municipality as part of government decentralization initiatives;

(ii) emphasis on improving water quality and quantity;

(iii) specific measures to improve WASA's service capacity (e.g. Dhaka WASA Turnaround program 2010–2015, separated master plans for water supply, sewerage and drainage);

(iv) particular attention towards innovations (e.g. single pit/double pit latrine technology, sanitation value chain approach, sanitation ladder framework) in sewerage management;

(v) improving coordination with relevant public and private agencies and ensuring community participation; and,

(vi) decentralizing the administrative system to deliver better implementation.

Once again, the implementation process for these strategies remains largely unclear, particularly in relation to how the decentralization system would function and at what scale compliance with the long-term plans should occur.

It is evident that niche-development continues apace, led by NGO initiatives that are driving capacity enhancement projects aimed at improving service delivery mechanisms at lower administrative units, with a particular focus on smaller developing cities. NGO interviewees indicated it was comparatively easier to work in emerging cities for there are fewer political and bureaucratic influences; fewer organizational overlaps; and more municipality leaders (publicly elected) who are motivated and keen to be involved. To some degree, this parallels the experiences within the developed city context, where less complexity can offer better opportunities for driving improvements in water management (see e.g. Brown, Ashley, & Farrelly, 2011). Similarly, other interviewees also observed how small and medium city contexts were well suited to furthering niche development, for example, as one interviewee phrased it:

Small towns still have the potentiality to get out from the trap where big cities are. If the pourashavas [municipalities] are given enough fund and capacity, they can run the service facilities smoothly; therefore, there are opportunities to improve the situation. [Interviewee 12].

To date, NGOs have occupied the local-scale innovation space, introducing several alternative technologies (see Table 4) for addressing absent piped water supply and sanitation challenges, such as piloting innovative toilet designs that consider hydrogeological constraints, disaster prevalence, and climate change impacts; however, their coverage remains very low (Interviewee 11). Notably, deficiencies within the sanitation system have opened up opportunities for experimenting with new concepts related to a sanitation value-chain, which is aimed primarily at addressing the very limited faecal sludge management (FSM) implementation (Interviewees 11, 16 and 17). While these contemporary niches remain in a nascent development stage at the time of writing, it remains unclear whether their influence, and that of current water and sanitation regimes, is sufficiently contributing towards delivering a sustainability transformation. Although the Government recently (2016) announced that Bangladesh was free from open defecation, there are many studies highlighting the poor design, construction and maintenance of sanitation septic tanks, and that significant attention is required to address emerging challenges related to sufficient faecal sludge management services (e.g. SACOSAN-VI, 2016). While Bangladesh has achieved significant progress towards delivering on the MDG water and sanitation target (SACOSAN-VI, 2016), questions remain regarding how sustainable these practices are and whether they will improve future ecological health and resource sustainability. The most critical phenomenon perceived by both media and interview participants was the absence of sewage management, which was becoming a

major source for surface water pollution. This is a clear risk for drinking water security and ecological wellbeing and sustainability. As outlined by an in-country representative of an NGO:

> *We are always happy with the apparent success we got but at what cost we do not know and also how sustainable that is we don't want to know. We are now very happy that we have 1% open defecation but do not know what will be the consequences regarding faecal sludge management. We do not have that vision, and are not analyzing and understanding our problems and just making short plans for tackling current situations.* [Interviewee 6]

5. Discussion

Analysing the historical and contemporary water resources management of Bangladesh, with a focus on urban developments, identified five major governance shifts from 1757 to 2016. These periods unfolded, against a background of three major socio-political contexts, which also contributed towards shifting and shaping water resource management. The governance approaches in each of the five periods reveal distinct characteristics and interlinkages across the landscape, regime and niche scales as denoted by the MLP. This analysis identified increasing niche activities as each time-period progressed and (re)defined the regime transformation (see Tables 3 and 4). Initially, landscape pressures at system level related to public health crises (e.g. cholera) (Table 3) which led to windows of opportunity for regime (re)development and ultimately the development of water supply and sanitation niches, whereas natural hazards (e.g. flooding) led to develop flood control/drainage initiatives (Table 4). Overall, the system level landscape pressures directed regime transformation towards mirroring European water management systems (state-led engineering-based urban water systems, see Table 5) and in later periods this was shaped by international development organizations and international frameworks (i.e IWRM; MDGs & SDGs). While the regime continues to (re)define its responses to landscape pressures (both at the system and service level, see Tables 3 & 4), these pressures have revealed windows of opportunity for varied niche development.

Water supply and flood control/drainage always received priority attention over sanitation, with the regime (following initiatives by DPHE, WASA, and Municipalities) emerging approximately 45 years ago during the first two periods of development, and their activities were largely guided by the socio-political (British and Pakistan) vision for reduced mortality and improved food security. Whereas, sanitation is largely driven by NGOs activities with donor investments and guidance, therefore despite regime transformation similar to water supply related services, improvements in sanitation largely remained within private initiatives or small scale services (except in Dhaka). This led to increasing gaps in sanitation, in particular, faecal sludge management or sewerage system development that currently seeking significant attention. On the other hand, flood control measures led building engineering structures and reducing water retention areas in cities and significantly challenging natural flushing system. Moreover, these initiatives were more or less segregated and compartmentalised for service delivery models, which is the outcome of the European influence. The introduction of donor organizations started to influence regime development and offered protected spaces for the growth of niche activities. For example, long-term planning became a key approach for water resource management and its approach to providing segregated access to water supply and sanitation services has become '*one of the key development challenges*' for not only Bangladesh but also other developing countries in the coming century (Kooy and Bakker, 2008, p. 1840). Groundwater discovery was a turning point for Bangladesh water management as it significantly influenced further regime development and increased citizen access to

drinking and irrigation water for more than a decade. However, its over-extraction resulted in a crisis of groundwater depletion and contamination in recent years.

The Bangladesh period saw regime-driven changes privilege development within Dhaka over other secondary cities, with the Dhaka WASA receiving Government attention and investment. As an outcome, Dhaka's water management system is far more advanced than other urban areas such as Chittagong, Mymensingh and Khulna. Nevertheless, deficiencies in water quality and resource security further complicated existing management approaches in Dhaka, which continue to require critical attention. Whilst the concept of integration and joint management initiatives guided water management at the beginning of Bangladesh period, the urban water system did not receive state attention. Despite the British establishing a formalized urban water system 138 years ago, it was only in 2000, via the adoption of the concept of IWRM, that significant advancements in water and sanitation were made (Table 4). As a result, the modern urban water system is relatively new and still currently evolving. Institutional and strategic directions further supported niche growth (such as rainwater harvesting, pond sand filter, CLTS, sanitation ladder) in the water sector, which has encouraged IWRM implementation and emerging new actors (NGOs, environmental activists) to be involved in water governance. Nevertheless, the extended time period between when key institutional directives have expired and their updates have led to short-term rather than long-term solutions, an important factor for challenging the current regime practices and dominant landscape discourses (Nastar, 2014). A surprising insight from this research, however, is that while major cities are largely entrapped within a 'business-as-usual' approach, innovative technologies and approaches are emerging in secondary cities (mostly driven by the NGOs). For example, water safety plans, faecal sludge management, sanitation value chain and rainwater harvesting are being incorporated and implemented within secondary cities (except rainwater harvesting, which is currently mandatory by law to incorporate in building design for urban development). This raises the question regarding whether a focus on secondary city developments (i.e. specific local context) are supporting the transformation towards a sustainable system, or just increasing the urban complexity, a question that is worthy of future research but beyond the scope of this paper.

Support from bi-lateral and multi-lateral organizations has been present throughout the history of water resource management in Bangladesh, which has increased its dependency on the investment criteria and strategic priorities of donors. This has increased the complexity of problems associated with contextual fit of proposed solutions (Rijke et al, 2012). While NGOs (national and international) have contributed to significant improvements in water and sanitation, transfer of inappropriate technology and management tools also led to developments that are unsustainable for Bangladesh. For example, exploiting the '*perceived abundance*' of groundwater sources for drinking water led to arsenic contamination and significant depletion of groundwater reserves. Moreover, the challenge associated with removal and disposal of human waste generated though onsite sanitation system is at a critical stage and contributing to extreme water and land pollution. Overall, there has been widespread uptake of alternative technologies and approaches without a longer-term consideration of potential consequences associated with polluted sources of drinking water (both surface and ground water), which has attracted government attention and deepened its concern for environmental issues. This concern placed expanded the objectives of urban water system development to ensure ecological health was addressed, as well as water supply and sanitation security.

The actor constellations involved in water governance in Bangladesh, presented in Table 5, was relatively simple and linear until

the Pakistan period, but grew in complexity following the Bangladesh period, with an increasing and diverse number of regime and niche actors. This increasing diversity, density and complexity within actors' constellations have contributed towards shaping and shifting paradigms, and challenging existing urban water systems. This observation reflects a pattern of change documented in the literature regarding the 'hydro-social contract' (Turton and Ohlsson 1999; Meissner and Turton, 2003) and hydro-political constellations (Cooper, 2011), which characterises an evolution from a simple liner relation between government as the service provider and the public as consumer, to a more complex involvement of other actors, such as civil society and NGOs. In Bangladesh currently, 39 organizations are responsible for water resource management, which creates enormous pressure on existing policies and directions for integration within the system. Although this complex actor network has generated a platform for building connectivity and linkages among different water users to self-organize (see Table 5), there remain unstable political and governance arrangements, which tends to result in ad hoc and short-term solutions by public agencies operating in major urban areas. The institutional directives defined different actors' responsibilities within the urban water system, but did not consider the increasing actor network complexity, and thus were limited in scope. This led to overlaps and ambiguity in how the service delivery models were framed within the urban water system.

Developments in Bangladesh's water sector have led to the emergence of many 'alternative' management tools (within context), such as long-term planning, joint initiatives, participatory and integrated approaches, co-management approaches, and more recently, mainstreaming adaptation and sustainability. All these management tools are important for purposefully designing and planning future water and sanitation interventions so they can underpin a sustainable future for Bangladesh (e.g. Malekpour, Brown, & de Haan, 2015). Whilst this research has demonstrated a comprehensive understanding of evolutionary processes of water development in Bangladesh, there remains much work to be done to develop an in-depth understanding on how these tools and approaches are supporting a sustainability transformation within the context of developing cities, where uneven growth has long been observed (e.g. Dhaka became the center of all activities for development while other cities have been left behind).

The use of the MLP as an analytical tool has helped to structure the examination of cross-scale interactions, as well as recognize the linkages and increasingly complex dynamics of actors and structures across these scales. However, further explanation regarding how these interconnections and contexts are influencing ongoing change in the system to support Bangladesh's sustainability transformation is required. Horizontal integration and coordination across different sectors and institutional directives is essential for improving adaptive capacities (Rouillard et al., 2014; Bai et al., 2009). The analysis here shows that as well as multi-scale interactions, interaction within the regime level and the niche level have also contributed towards developing adaptive capacity. However, the MLP was not able to provide analytical insight into these 'within-level' interactions and their impacts on the system. Analysing the development of adaptive capacity therefore requires a further tool(s) for understanding the horizontal interactions in order to provide a holistic view of the change processes that are needed to support sustainability transformations.

6. Conclusion

This research developed a holistic understanding of the changing nature of the complex urban water system in Bangladesh. Characterizing such shifts by analyzing more than 250 years of governance approaches has improved our understanding of the processes that have shaped the contemporary water governance regime. These change processes have contributed towards developing key governance approaches that can support adaptive capacities within the system including long-term planning, participatory and bottom-up learning, multi-level interactions and diverse actor engagements, all of which are currently visible in different water-related activities. However, given the scale at which this research was undertaken, it remains unclear how these processes are individually, or collectively, guiding the pathway to sustainability transformation. As mentioned earlier, niche activities are currently focusing on small scale and local contexts, however, there remains ambiguity about how these are contributing towards a sustainability transformation of the urban water system in Bangladesh. Nevertheless, this study reveals how the Bangladesh urban water sector has exhibited scope for adopting a new governance model based on adaptive capacity. A more nuanced and detailed understanding of the contemporary ingredients for change is now needed to support a sustainability transformation within Bangladesh's water sector. It would also be valuable to consider the opportunities and constraints for emerging secondary cities in relation to advancing more sustainable urban water practices as an additional further research direction.

Conflict of interest

None declared.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.worlddev.2018.05.003.

References

Agyenim, J. B., & Gupta, J. (2012). IWRM and developing countries: Implementation challenges in Ghana. *Physics and Chemistry of the Earth, 47–48*, 46–57.

Allen, A., Dávila, J. D., & Hofmann, P. (2006). *Governance of water and sanitation services for the peri-urban poor.* London: University College London. The Development Planning Unit.

Araral, E., & Yu, D. (2010). *Asia water governance index.* Lee Kuan Yew School of Public Policy.

Bai, X., Wieczorek, A. J., Kaneko, S., Lisson, S., & Contreras, A. (2009). Enabling sustainability transitions in Asia: The importance of vertical and horizontal linkages. *Technological Forecasting and Social Change, 76*(2), 255–266.

Bakker, K., Kooy, M., Shofiani, N. E., & Martijn, E.-J. (2008). Governance failure: Rethinking the institutional dimensions of urban water supply to poor households. *World Development, 36*(10), 1891–1915.

Bakker, M. H. (2009). *Transboundary river floods and institutional capacity.* Wiley Online Library.

Bangladesh Delta Plan. (2015). http://www.bangladeshdeltaplan2100.org.

Bangladesh Bureau of Statistics (BBS) (2011). *Statistical year book of Bangladesh, 2011.* Dhaka, Bangladesh: Government of Bangladesh.

Bangladesh Water Act (2013). *Water resource and planning organization.* Dhaka, Bangladesh: Government of Bangladesh.

Benson, D., Gain, A., & Rouillard, J. (2015). Water governance in a comparative perspective: From IWRM to a 'nexus' approach? *Water Alternatives, 8*(1).

Berkhout, F., Verbong, G., Wieczorek, A. J., Raven, R., Lebel, L., & Bai, X. (2010). Sustainability experiments in Asia: Innovations shaping alternative development pathways. *Environmental Science & Policy, 13*(4), 261–271.

Biswas, A. K. (2008). Integrated water resources management: Is it working? *International Journal of Water Resources Development, 24*(1), 5–22.

Biswas, A. K., & Tortajada, C. (2010). Future water governance: Problems and perspectives. *Water Resources Development, 26*(2), 129–139.

Brammer, H. (2004). *Can Bangladesh be protected from floods?* University Press.

Brammer, H. (2010). After the Bangladesh flood action plan: Looking to the future. *Environmental Hazards, 9*(1), 118–130.

Brown, R., Ashley, R., & Farrelly, M. (2011). Political and professional agency entrapment: An agenda for urban water research. *Water Resources Management, 25*(15), 4037–4050.

Brown, R., Keath, N., & Wong, T. (2009). Urban water management in cities: Historical, current and future regimes. *Water Science and Technology, 59*(5), 847–855.

Cooper, R. V. (2011). *Promoting and contesting hydropower development: Actors and narratives in the lower Mekong basin's hydropolitical constellation* (Ph.D. thesis). University of Newcastle. Retrieved from https://theses.ncl.ac.uk/dspace/bitstream/10443/1304/1/Cooper%2011.pdf.

Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage Publications.

Ferguson, B. C., Brown, R. R., & Deletic, A. (2013). Diagnosing transformative change in urban water systems: Theories and frameworks. *Global Environmental Change, 23*(1), 264–280.

Gain, A. K., & Schwab, M. (2012). An assessment of water governance trends: The case of Bangladesh. *Water Policy, 14*(5), 821–840.

Gauri, V., & Galef, J. (2005). NGOs in Bangladesh: Activities, resources, and governance. *World Development, 33*(12), 2045–2065.

Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study. *Research Policy, 31*(8), 1257–1274.

Geels, F. W. (2005). *Technological transitions and system innovations: A co-evolutionary and sociotechnical analysis*. Edward Elgar Publishing.

Geels, F. W. (2006). The hygienic transition from cesspools to sewer systems (1840–1930): The dynamics of regime transformation. *Research Policy, 35*(7), 1069–1082.

Geels, F. W., & Raven, R. P. J. M. (2006). Non-linearity and expectations in niche-development trajectories: ups and downs in Dutch biogas development (1973–2003). *Technology Analysis & Strategic Management, 18*(3/4), 375–392.

Gleick, P. H. (2003). Global freshwater resources: Soft-path solutions for the 21st century. *Science, 302*(5650), 1524–1528.

Gupta, A. D., Babel, M. S., Albert, X., & Mark, O. (2005). Water sector of Bangladesh in the context of integrated water resources management: A review. *International Journal of Water Resources Development, 21*(2), 385–398.

Harrison, M. (1994). *Public health in British India: Anglo-Indian preventive medicine 1859–1914*. Cambridge University Press.

Holtz, G., Brugnach, M., & Pahl-Wostl, C. (2008). Specifying "regime" — A framework for defining and describing regimes in transition research. *Technological Forecasting and Social Change, 75*(5), 623–643.

Hossain, M. A. A., Weng, T. K., & Mokhtar, M. (2012). *Institutional aspects of water management: Evaluating the experience*. Nova Science Publishers, Inc..

Joint Monitoring program. (2009). WHO/UNICEF joint evaluation report for water supply in Bangladesh.

Kemp, R., Parto, S., & Gibson, R. B. (2005). Governance for sustainable development: Moving from theory to practice. *International Journal of Sustainable Development, 8*(1–2), 12–30.

Keath, N. A., & Brown, R. R. (2009). Extreme events: Being prepared for the pitfalls with progressing sustainable urban water management. *Water Science and technology, 59*(7), 1271–1280.

Kooy, M., & Bakker, K. (2008). Splintered networks: The colonial and contemporary waters of Jakarta. *Geoforum, 39*, 1843–1858.

Khan, M. M. (1997). Urban local governance in Bangladesh. In N. Islam & M. M. Khan (Eds.), *Urban governance in Bangladesh and Pakistan*. Dhaka, Bangladesh: Centre for Urban Studies.

Lawhon, M., & Murphy, J. T. (2011). Socio-technical regimes and sustainability transitions: Insights from political ecology. *Progress in Human geography, 36*(3), 354–378.

Loorbach, D. (2007). *Transition management: new mode of governance for sustainable development*. *Dutch Research Institute for Transitions (DRIFT)*.

Loorbach, D., & Rotmans, J. (2010). The practice of transition management: Examples and lessons from four distinct cases. *Futures, 42*(3), 237–246.

Malekpour, S., Brown, R. R., & de Haan, F. J. (2015). Strategic planning of urban infrastructure for environmental sustainability: Understanding the past to intervene for the future. *Cities, 46*, 67–75.

Meadowcroft, J. (2005). Environmental political economy, technological transitions and the state. *New Political Economy, 10*, 479–498.

Meissner, R., & Turton, A. R. (2003). The hydrosocial contract theory and the Lesotho Highlands Water Project. *Water Policy, 5*, 115–126.

Mitchell, B. (2005). Integrated water resource management, institutional arrangements, and land-use planning. *Environment and Planning A, 37*(8), 1335.

Moinuddin, G. (2010). Metropolitan government and improvement potentials of urban basic services governance in Dhaka city, Bangladesh: Rhetoric or Reality? *Theoretical and Empirical Researches in Urban Management, 5*(14), 59–81.

rittMultiple Indicator Cluster Survey (MICS). (2009). New York: United Nations Children's Fund, Bangladesh & Bangladesh Bureau of Statistics; 2010.

Nastar, M. (2014). What drives the urban water regime? An analysis of water governance arrangements in Hyderabad, India. *Ecology and Society, 19*(2), 57.

Newman, M. E. (2001). The structure of scientific collaboration networks. *Proceedings of the National Academy of Sciences, 98*(2), 404–409.

Nowreen, S. M., Khan, S. A., & Huq, H. (2011). Development of an operational IWRM framework in a selected small scale water resources development sector project in Bangladesh. *South Asian Water Studies, 2*(2), 6–26.

Ojendal, J., Hansson, S., & Hellberg, S. (2012). Politics and Development in a Transboundary Watershed. https://link-springer-com.ezproxy.lib.monash.edu.au/content/pdf/10.1007%2F978-94-007-0476-3.pdf.

Pahl-Wostl, C. (2007). Transitions towards adaptive management of water facing climate and global change. *Water Resources Management, 21*(1), 49–62.

Pahl-Wostl, C. (2008). *Requirements for adaptive water management. Adaptive and integrated water management*. Springer.

Pahl-Wostl, C., & Sendzimir, J. (2005). The relationship between IWRM and Adaptive Water Management. NeWater Working Paper No 3.

Pahl-Wostl, C., Holtz, G., Kastens, B., & Knieper, C. (2010). Analyzing complex water governance regimes: The management and transition framework. *Environmental Science & Policy, 13*(7), 571–581.

Pant, L. P. (2016). Paradox of mainstreaming agroecology for regional and rural food security in developing countries. Technological Forecasting & Social Change (article in press).

Pérez-Latre, F. J., Portilla, I., & Blanco, C. S. (2011). Social networks, media and audiences: A literature review. *Comunicación y Sociedad; Pamplona, 24*(1), 63–74.

Rabbani, G. (2011). *Water supply in Dhaka in Pakistan period*. Bangladesh Asiatic Society Press.

Rahman, H., Haque, A., Khan, S. A., Salehin, M., & Bala, S. K. (2005). *Investigation of hydrological aspects of flood-2004 with special emphasis on Dhaka city. Final Report*. Dhaka: Institute of Water and Flood Management, Bangladesh University of Engineering and Technology.

Rana, M. P. (2011). Urbanization and sustainability: Challenges and strategies for sustainable urban development in Bangladesh. *Environmental Development & Sustainability, 13*, 237–256.

Raven, R., & Geels, F. W. (2010). Socio-cognitive evolution in niche development: Comparative analysis of biogas development in Denmark and the Netherlands (1973–2004). *Technovation, 30*(2), 87–99.

Raven, R., Kern, F., Smith, A., Jacobsson, S., & Verhees, B. (2016). The politics of innovation spaces for low-carbon energy: Introduction to the special issue. *Environmental Innovation and Societal Transitions, 18*, 101–110.

Rijke, J., Brown, R., Zevenbergen, C., Ashley, R., Farrelly, M., Morison, P., & van Herk, S. (2012). Fit-for-purpose governance: A framework to make adaptive governance operational. *Environmental Science Policy, 22*, 73–84.

Rip, A., & Kemp, R. (1998). *Technological change*. Battelle Press.

Rotmans, J., Kemp, R., & Van Asselt, M. (2001). More evolution than revolution: Transition management in public policy. *Foresight, 3*(1), 15–31.

Rouillard, J. J., Benson, D., & Gain, A. K. (2014). Evaluating IWRM implementation success: Are water policies in Bangladesh enhancing adaptive capacity to climate change impacts? *International Journal of Water Resources Development, 30*(3), 515–527.

Smith, A., & Raven, R. (2012). What is protective space? Reconsidering niches in transitions to sustainability. *Research Policy, 41*(6), 1025–1036.

SACOSAN-VI, Bangladesh Country paper. (2016). Sixth South Asian Conference on Sanitation (http://www.sacosanvi.gov.bd/data/frontImages/Bangladesh_Country_Paper.pdf).

Sectoral Development Plan-Water and Sanitation (2010). *Ministry of local government, rural development and cooperatives*. Government of the People's Republic of Bangladesh.

Sectoral Development Plan (2015). *Ministry of local government, rural development and cooperatives*. Government of the People's Republic of Bangladesh.

Sheesh, K. M. (2011). *Water Supply in Dhaka in Bangladesh Period*. Asiatic Society Bangladesh.

Sultana, P., Thompson, P., & Green, C. (2011). Can England learn lessons from Bangladesh in introducing participatory floodplain management? *Water Resources Management, 22*(3), 357–376.

Turton, A. R., & Ohlsson, L. (1999). Water scarcity and social adaptive capacity: Towards an understanding of the social dynamics of managing water scarcity in developing countries. Paper presented at the Stockholm Water Symposium 9–12.

UNICEF Bangladesh. (2015). Sanitation in Bangladesh: Past learning and future opportunities. DOI: 10.13140/RG.2.2.34126.05447.

UNICEF Bangladesh. (2010). A case for geographic targeting of basic social services to mitigate inequalities in Bangladesh.

Van de Meene, S. J., Brown, R. R., & Farrelly, M. A. (2011). Towards understanding governance for sustainable urban water management. *Global Environmental Change, 21*(3), 1117–1127.

Van der Brugge, R., & Rotmans, J. (2007). Towards transition management of European water resources. *Water Resources Management, 21*(1), 249–267.

Van de Poel, I. (2000). On the role of outsiders in technical development. *Technology Analysis & Strategic Management, 12*(3), 383–397.

Wieczorek, A. (2017). Sustainability transitions in developing countries: Major insights and their implications for research and policy. *Environmental Science and Policy*. https://doi.org/10.1016/j.envsci.2017.08.008.

Wolfram, M. (2016). The role of cities in sustainability transitions: New perspectives for science and policy. In E. Kim & B. H. S. Kim (Eds.), *Quantitative regional economic and environmental analysis for sustainability in Korea* (pp. 3–22). Singapore: Springer.

4.3   Increasing adaptive capacity in Bangladesh's urban water system

The data analysis in the preceding section reflected a regime-driven urban water sector in Bangladesh, where changes have been prominent in the institutional domain during different periods of development, and aligned to relevant policy formulation, adoption of strategic planning and establishment of relevant designated authorities (see Figure 4.1). The changes in institutional domains were the outcome of the vision of the government to tackle water governance dilemmas associated with delivering and managing urban water services. Overall, there is a clear distinction between policy and strategy development and developing adaptive capacities to support on-ground implementation. Extending this assessment, the following section further examines the prevailing adaptive capacities by adopting the adaptive capacity[1] and attributes (ACA) framework outlined in chapter 2 (p. 53).

The empirical research data revealed there has consistently been an emphasis on water supply and servicing as opposed to sanitation and drainage since the inception of the urban water system in 1878, with Dhaka the centre of attention. This is reflected in the establishment of the Dhaka water supply and sewerage authority (DWASA) in 1963 and continued financial and research support for increasing capacity to deliver water to meet increasing demands. However, it took more than 50 years to build the infrastructural and organisational capacity of DWASA to secure water supplies that meet demand (DWASA annual report, 2015), although there remain critical questions raised by the interviewees and media emphasis regarding the quality and the sustainability of the overall system (further details below). In cities outside Dhaka (three SMAs: Chittagong, Khulna and Rajshahi),[2] water management authorities were considered by interviewees to be lacking relevant capacity and resources (i.e. limited pipe connections and poor water quality) to deliver essential services. In this instance, the relevant 'capacity' context has been idealised based on the ACA framework. For example, the management strategies adopted by these SMAs are rigid, top-down and lacking necessary coordination with the relevant organisations and community. Similarly, this 'capacity' issues remained critical in other urban areas of Bangladesh, including secondary cities[3] (further

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[1] Adaptive capacity in this thesis refers to the capacity of a system (here urban water system) in which the environment where the system exists is changing (see chapters 2 and 4 for further details).
[2] According to the Bangladesh Bureau of Statistic (BBS, 2011) Statistical metropolitan areas (SMAs) includes city corporations and adjoining areas with urban characteristics which includes three cities.
[3] Medium to small emerging cities with a population less than 100,000, see chapter 1, p. 2.

unpacked in chapter 5), where 'Pourashavas'[4] have limited hours of water supply (2–4 hours per day), and most areas have less than 50 per cent of household water connection coverage (Rabbani, 2011). The Department of Public Health and Engineering (DPHE), an umbrella agency for Pourashavas, were identified by the interviewees as having insufficient capacity and technology in relation to the 'capacity' framed in ACA framework to develop and support water supply systems in the Pourashavas.

Urban water related ministries and organisations

Ministry of Local Government, Rural Development and Cooperatives

Department of Public Health and Engineering (DPHE)
Local Government Engineering Division (LGED)
Local Government Institutes (LGIs) (Municipalities, City Corporations, Ward)
Water supply and sewerage authorities (WASAs)
Bangladesh Agricultural Research Council (BARC)

Ministry of Water Resource

Bangladesh Water Development Boards (BWDB)
Water Resource Planning Organization (WARPO),
River Research Institute (RRI)
Joint River Commission Bangladesh (JRCB)
Flood Forecasting and Communication Organization (FFCO)
Department of Haor and Wetland Development
Institute of Water Modelling (IWM)
Centre for Environmental and Geographic Information Services (CEGIS)

Development Partners

Department of Environment (DoE)
World Bank and United Nation based organizations (eg. UNICEF, WHO, UNDP) Asian Development Bank (ADB) and Swiss and Danish development organizations (DFID, DANIDA, SIDA)
International/National NGOs-
Water Aid Bangladesh, Plan BD, World Vision, Practical Action, BRAC, DAM, other national NGOs
Collaborative Agencies-WASH Alliance, National Sanitation Task Force.

Relevant policies

The drainage Act, 1880
Drinking water standard, 1984
Government agencies (a few) for drinking water supply
Gadget notification for slum water connection, 1993
Water supply and sewerage Act, 1996
National policy for drinking water and sanitation1998
National sanitation strategy, Hygiene strategy   **UWM**

Bengal Municipality Act, 1864, 1938
Local Self Government Act, 1885
Local Government Loan Act, 1879
National Water Policy, 1999
National Water Management Plan, 2004
Integrated water resource management
Upzilla Parishad Act, 1998
Pro-poor Strategy
Water and sanitation sector development plan
Long-term perspective plan (2010-2021)
Sectoral development plan (2011-2025)
BCCSAP, 2009
Bangladesh Water Act, 2013
Bangladesh delta plan, 2100

20 years master plan
Implementation of small scale projects
Groundwater Ordinance, 1981
National Water Policy (1987, '91)
Joint national and international projects
Participatory Guideline
Bangladesh water and flood management strategies 1995
Environmental Conservation Act, 1995 and Rules 1997
National Water Resource Council
Haor Development Board Act, 2014   **WRM**

WRM - Water Resource Management
UWM - Urban Water Management

- Represent policy and plans that overlap WRM and UWM

Figure 4.1 Authorities/organisations and policies since the inception of urban water system in Bangladesh.

In the interviews, secondary cities were identified as having limited management and infrastructural capacities for improving water management systems. Conversely, interviewees regarded secondary cities as having greater opportunities, due to there being less political and bureaucratic complexity, to implement innovations and alternative approaches (section 4,

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[4] 'Pourashava' is the local term for municipality and there are 209 Pourashavas, mostly at the district and subdistrict scale as declared by local government authorities (BBS, 2011). See further details in Yasmin et al., 2018, p. 389.

tables 3 and 4, p. 94 and 95). ACA framework noted that unpacking the presence of enablers, such as bridging organisations, participatory approach could provide guidance on how to facilitate governance structure and processes towards building necessary capacity. For example, interviewees identified several projects, including the 'Water Safety Plans (WSPs)' and urban governance improvement projects (UGIIP I and II) being implemented in secondary cities. The research data presented in section 4.1 could not indicate how successful these niche activities have been in improving the adaptive capacities of the overall urban water system. They do, however, reveal the critical role of international development agencies (IDAs)[5] as providing bringing functions that are designing and guiding the project activities and implementation strategies in the secondary city context. The research data (section 4, p. 93-100) indicates these IDAs' contribution in shaping the urban water system in Bangladesh. For example, interviewees indicated that the changes in policy were largely an outcome of following contemporary international guidelines and IDAs' recommendations; however, respondents were quick to mention that the government is also keen to develop sustainable and adaptive water resources, including the urban water system (e.g. adoption of IWRM in national water policy, signatory of the MDGs/SDGs).

The policy and strategic development planning continue to change, with further emphasis on integration and participatory approaches as similar to ACA framework for managing water resources. The research data not only found that the policy is changing, it also found change in the processes for policy formulation. Examples include developing a participatory and multidisciplinary team for reviewing and formulating policies, an aim to instigate bottom-up learning in relation to local problems, adoption of different strategic time frames and decentralisation of the administrative authority (see more in section 4.5, p. 98). The ACA framework identifies all these attributes for developing adaptive capacity. However, the data remain insufficient to determine whether these changes have applied to the implementation activities. For instance, as mentioned in discussion (section 5, p. 100), the government remains a dominant actor in decision-making despite decentralisation of the system and given local-level actors were excluded from decision-making processes, trust in government policies and statements remains low (section 4.5, p. 98). Therefore, this research infers that while

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[5] IDAs are the development partners of the Bangladesh Government such as the ADB and UN-based organisations. See Figure 4.1

Bangladesh's urban water sector has built necessary policy capacity to drive sustainable transformation, this does not readily translate to the implementation level.

On the issue of implementation, interviewees specifically mentioned the failure of approaches to IWRM. While the adoption of IWRM brought participatory and co-management thinking together to guide water governance in Bangladesh, several interviewees continued to stress that neither IWRM nor participatory/co-management is happening in Bangladesh (section 4.4, p. 97). The interviewees further pointed out that participatory approaches are far more visible in NGO-led niche initiatives (with support from IDAs), where the leadership from NGOs/IDAs is guiding the design and implementation, primarily at project scales. The interviewees further reflected that these initiatives appear to be following IWRM in their design and implementation and also act as a bridging platform to reduce gaps between government endeavour and community responses.

The ACA framework recognises this role of bridging organisations and leadership in delivering essential attributes to improve the adaptive capacity of the urban water system. As mentioned earlier in this section, these NGOs and IDAs led niche innovations focusing on secondary cities. This requires further investigation to determine the effectiveness of these enablers in influencing or driving a shift in practice in secondary cities' water governance practices. Indeed, the next chapter utilises the ACA framework to further unpack these project-scale activities to understand how IDAs are supporting or inhibiting the adaptive capacity required to drive urban water sector towards sustainability.

Considering national efforts for IWRM implementation, particularly in the mega[6] and other big cities, interviewees indicated that WASAs and other national-level agencies adopted IWRM and participatory approaches in the broader vision and planning documents (see Table 5 in section 4, p. 97). Moreover, interviewees indicated these WASAs and other national agencies do not follow IWRM or co-management approaches, but use a conventional top-down, hierarchical mode of governance. This approach limits opportunities for communities and other actor clusters to be involved. This is the opposite of the ACA framework, which supports a mix of top-down and bottom-up governance, wider participation and diverse actors.

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[6] Cities with more than 10 million people.

If continued, the conventional approach is likely to confine the urban system to the status quo or lock-ins (see further details in chapter 1).

While the urban water system continues to operate through conventional governance approaches, interviewees acknowledged the increasing organisational and stakeholder diversity at different implementation levels. Such diversity has been built over the development periods in Bangladesh since the inception of urban water system in 1878 to 2016 (see Figure 4.1, p.104). For instance, Dhaka, Chittagong, Rajshahi and Khulna city have their own authority responsible for water supply and sewerage (WASAs). Storm water management and sewerage disposal are managed by designated city corporations (section 4.1, p. 93) and many private organisations have been involved over the years to manage the delivery of urban water services. The IDAs and national-scale NGOs are introducing different technologies and approaches to ensure access to water and sanitation in Bangladesh. As of 2017, thirty-nine government agencies have been involved in the water sector, and thousands of private sector companies are supporting government initiatives, along with their own individual projects. The ACA framework identified this organisational diversity and relevant stakeholder involvement as critical for developing adaptive capacities; however, it also pointed to the need for coordination and collaboration. With organisational diversity and complexity dominating the urban water system in Bangladesh, poor services in water supply and sanitation raise doubts about organisational capacity to meet increasing need and may create crises and vulnerabilities of these urban water systems.

In the Bangladesh case, coordination and communication were identified by interviewees as the common challenges to rapid deployment of modern technologies and approaches. Interviewees identified initiatives such as government partnerships with IDAs and NGOs, among others. Interviewees further highlighted that in such schemes, public agencies are responsible for hardware installation (hand tube wells or a shared piped system for water supply and a shared or community latrine), while NGOs are responsible for soft approaches (awareness raising) and the community is responsible for maintaining the hardware (Table 5, p. 97). This three-way partnership approach has had a positive impact on improving institutional capacity, in particular for building management capacity at the lower administrative level. Moreover, interviewees indicated other partnership alliances primarily developed by IDAs (e.g. the NARRI consortium, the WASH alliance) from national to local

levels also aimed at fostering capacity building and learning within the local administrations responsible for urban service delivery.

These partnerships not only support coordination, they also nurture relationships with civil society, corporate bodies, media and other relevant stakeholders. The ACA framework regards these types of partnership and coordination strategies as important for creating formal and informal networks, encouraging collective actions, developing leaders and champions, and driving sustainable activities. However, interviewees expressed frustration with the way national agencies were responding and indicated that state incapacity to lead such partnerships created distrust.

A comparison of the research data with the ACA framework revealed that despite policy and strategic planning for participatory and integrated approaches, gaps remain in the transition to implementation. Some on-ground activities indicate diversity in organisations and involved actors, yet these organisations and actors lack the skills and management capacity required to deliver sustainable services. Some forms of bridging capacity have been shown to reduce implementation gaps. IDA and NGO leadership in the formation of formal and informal partnerships/networks have also been found to achieve this. However, considering that the demand for water supply and sanitation services is increasing, and delays in updating policies and implementation strategies, these are not enough to develop the capacity needed to drive Bangladesh's urban water system towards sustainability. This further require necessary strategic and policy directions on how to guide these enablers and attributes to drive sustainable transformation.

4.4 Summary

This chapter has outlined the evolution of Bangladesh's urban water system by incorporating adaptive governance strategies for growing adaptive capacity in the water governance system. This analysis has fostered a deeper understanding of the broader context of the country's urban water system and its transformation processes. The multi-level perspective was adopted to understand the vertical relationships and development of urban water governance between among various levels of government, while an adaptive governance lens was used to examine the presence or absence of key adaptive strategies and capacities. Overall, this part of the research identified capacity development, in particular at the policy level, institutional changes,

organisational diversity and participatory strategies, diverse actors and networks, bridging functions and leadership. Collectively, these insights have assisted in building an understanding of the interdependencies and relations of these attributes.

In sum, institutional changes over the period have improved the capacities of organisations and individuals to deal with increasing complexity and uncertainty, creating an ability to produce promising strategic directions and policy reforms for water resource development in Bangladesh. Despite key gaps and a lack of direction or guidance on how to implement these in local contexts, institutional changes have provided windows of opportunity for innovation and learning through formal and informal activities. While there remain limitations and inequities in access to and mobilisation of resources, particularly at the lower administrative level, upscaling innovation and learning processes are progressing, albeit at a relatively slow pace. While policy reform reflects the public agency response towards developing an integrated water management system, leadership to drive changes in this sector exists mainly in the IDAs and NGOs.

Over the 250 years of urban water development, Bangladesh has witnessed the promising development of organisational capacity to ensure smooth urban water service delivery. However, most organisations failed to deliver these services due to insufficient technical and financial capabilities, overlapping responsibilities, lack of coordination, and ambiguity in defining roles and responsibilities. Thirty-nine public agencies and thousands of NGOs are now working in the water sector and progress has been seen in access to drinking water and pit latrines. However, the quality of these services and sustainability of the system is not certain. Participation and collective efforts in water resource development have brought more success in flood management and agricultural developments due to IWRM implementation.

Participatory arrangements in the urban context have been confined to selective (mostly powerful elite) civil society involvement through different coordination committees at the local scale. This has been evident from the inception of the urban water system in the country. Engagement with poor and disadvantaged communities, particularly in slum areas, is limited to paying bills for their facilities, rather than giving them a voice in decision-making. While this participation involves diverse actors in urban water management, different networking opportunities are emerging in decision-making processes.

Improvements in public access to water and sanitation services and more broadly towards public health benefits in Bangladesh is very uneven. Such improvements are largely dependent on institutional and network dynamics. Continued progress will depend on the interconnections and mutual trust among the network of actors, supporting and building the capacity to reform local systems, providing legitimacy and authority, and winning the trust of civil society so that people are more receptive to change. As Bangladesh's urban water system continues to evolve, there remains a lack of clear understanding of the complexity at different implementation scales. The progress of the above mentioned adaptive governance strategies and capacity context (i.e participation, collaboration, leadership, and learning) for developing adaptive capacities mostly remains in policy and strategy domains, which are well aligned with changing international and national guidelines.

However, it may not be able to transform the system towards sustainability due to lack of change at other implementation scales (small and medium cities). This chapter has focused on the development of an urban water system, particularly in major cities. Other cities are likely to have different development pathways that require specific analysis. Following on from this observation, the next chapter discusses the innovative/alternative approaches implemented through IDAs and government agencies in the secondary city context to examine the dominant change processes, and further assess the level of adaptive capacities developed in the urban water system.

Chapter 5

Water governance in a multi-level system: The case of an emerging city

5.1 Introduction

Analysis of the evolution and key shifts in urban water governance in Bangladesh, presented in the previous chapter, revealed a variety of actors and initiatives at different implementation levels, coalescing to underpin sectoral changes and showing how adaptive capacity improvements have occurred, largely in the policy and strategy domains. Since the formalisation of the urban water system, Dhaka, as the political, economic and population centre of Bangladesh, has been the most privileged of its cities, receiving financial and research support, compared to other cities (i.e. other SMAs[7] and secondary cities[8]). While chapter 4 shows Dhaka as being more advanced in terms of technology, infrastructure development and capacity, it also portrays the urban water system as 'locked-in' (i.e. a large engineering focus on infrastructure development for resolving water supply and sewerage disposal issues) and increasingly complex and bureaucratic, constraining progress on Dhaka's water management trajectory.

Secondary cities, however, are increasingly regarded as an important leverage point in urban system transformation, for they are yet to be extensively developed (Jaglin, Repussard and Belbéoc'h, 2011; de Noronha and Vaz, 2014; Tutusausa and Schwartz, 2018). Indeed, the Bangladeshi Government has begun to focus to develop secondary cities as part of the broader agenda of transforming from a low-income group to a middle-income country by 2020. This has led to investment in innovative and multi-scale strategies (e.g. capacity enhancement projects; innovative toilet design; decentralised water supply networks at small scale; disaster-proof city development plans) and an emphasis on decentralisation to address IWRM implementation challenges (chapter 4). Despite this growing attention, the research data in chapter 4 shows that secondary cities have less technology, infrastructure development, institutional and operational actor capacity.[9] The lack of institutional and actor capacity is acknowledged in the relevant academic literature. Explanations include ignorance of these cities' development on the part of the state due to urban bias between large cities and small cities, where larger cities are favoured by the government due to their exploitable resources

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[7] According to the Bangladesh Bureau of Statistic (BBS, 2011), statistical metropolitan areas (SMAs) include city corporations and adjoining areas with urban characteristics, including three cities. See details in chapter 4, publication 2, p. 389.

[8] The medium and small emerging cities with a population of less than 100,000. See Rondinelli, 1983.

[9] Secondary cities have been long ignored in development agendas and been neglected for developing governance / management capacity to handle city development activities including water and sanitation. See details in chapter 4 (Publication 2) Gupta, 2012; Mugabi and Njiru, 2006; Owusu, 2005; Rondinelli, 1983; Shah, 2013.

and important attributes for political control (Owusu, 2005; Rondinelli, 1983). This raises questions about whether the innovative and multi-scale strategies being implemented in secondary cities as mentioned in chapter 4 (p. 99) are fostering the capacities needed to deliver more sustainable urban water systems.

This chapter extends the analysis undertaken in the preceding chapter and applies a similar approach to assess whether Mymensingh, a secondary city, is technologically and institutionally less 'locked in' regarding urban water practices, given it has a different 'starting line' to Dhaka. This chapter examines the urban water innovations and strategies underway in Mymensingh, a secondary (emerging) city in Bangladesh that is undergoing significant changes to its planning and management of urban water resources. The changes are in response to growing challenges of water quality and climate-induced vulnerabilities (see World Bank, 2017). The empirical qualitative data collected through semi-structured interviews, informal focus group discussions and secondary document analyses (details outlined in chapter 3) have been analysed to present a historical assessment of changes over time within city boundaries.

The chapter also examines whether national strategies that have been directed towards improving urban water governance and management capacities in the Mymensingh Pourashava have assisted in establishing conditions enabling sustainability transformation. 'Pourashava' is a local term for a municipality and is the formal public institution under the central agency, the Local Government Engineering Department (LGED), in the Ministry of Local Government, Rural Development and Co-operatives (MoLGRD&C). Mymensingh Pourashava is responsible for conducting city-building activities in Mymensingh, including water management (i.e. generating taxes, solid waste management, cleaning and maintenance of development works, such as roads and streetlights) (Pourashava Act, 2009). The chapter utilises the MLP framework that is structuring urban water development in Mymensingh by highlighting the interplay of institutions and actors at niche and regime levels (i.e. policy and implementation).

This is achieved by analysing the evolution of urban water governance approaches since the inception of the urban water system in Mymensingh. The timeframe is 1893 to 2017, and the chapter examines how these factors at multiple levels have contributed to increasing or hindering adaptive capacity. Drawing on the ACA guiding framework developed in chapter 2 (p. 53), the analysis of adaptive capacity is then undertaken to understand the enabling

conditions that developed through reviewing the global South cases. The following section outlines the evolution of urban water governance by developing a chronology similar to that of chapter 4. This chronology presents three development periods, key legislation, polices and plans, increasing complexity across actors and institutions and is presented in Table 5.1 (p. 115).

5.2 The evolution of urban water governance in Mymensingh

Mymensingh Pourashava is one of the few secondary cities that has received significant attention at the national level in Bangladesh, due in part to its proximity to Dhaka (125 km). Mymensingh was recently declared a divisional city (2015).[10] Mymensingh Pourashava was established in April 1869 and was recognised by the British Government for its regional importance; however, the Pourashava remained underdeveloped for a long period of time (e.g. during the Pakistan and early Bangladesh periods; chapter 4, p. 99), unlike other secondary cities in Bangladesh.

Reasons for this include political turmoil (i.e. conflicts with Pakistani rule and then being a newly independent country with a broken economy), the national attention required for flood management and food security, particularly in rural areas (chapter 4), and finally the urban bias[11] where Dhaka and other SMAs received favours whereas other cities were left behind (chapter 4, p. 99). Although urbanisation began as far back as the 1980s, and has doubled over the past five years, there were few strategies or planning documents aimed at developing Mymensingh city before 2005 (MSDP, 2015; chapter 4). Mymensingh Pourashava is governed by the Pourashava Parishad (council) under the Pourashava Act (2009), which consists of twenty-one wards with elected members from each ward.[12]

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[10] For administrative purposes Bangladesh is divided into 64 districts under eight divisions and districts are subdivided into smaller administrative units such as upazilla (subdistrict), pourashavas and union councils. There are 491 upzilla and 4554 union councils: <https://bangladesh.gov.bd/index.php>.

[11] The concept of urban bias that exists between large cities and small cities, where larger cities are favoured by the government due to their exploitable resources, and important attributes for political control. See Rondinelli, 1983; Owusu, 2005.

12 Optional local administrative level in a city in Bangladesh for electoral purposes.

Table 5. 1 The evolution of governance approaches and actor clusters influencing Mymensingh urban water governance

Socio-political context	Period of Development	Key legislations, policies and plans		Shifts in urban water governance agenda and key actor-clusters	
British, Pakistan and earlier Bangladesh period	**Formalising and developing the urban water system (1893-1995)**	Central /national scale	- Water supply and sanitation ordinance, 1963 - Bangladesh Local Councils and Municipal Committees (Amendment) order 1972 - Drinking water standard in 1984	Central agencies (i.e. DPHE and LGED) control Pourashava's activities and led to develop a urban water system guided by state and donor organization (ADB) with a focus on water supply and drainage.	Donor organizations (i.e. ADB) LGRD&C and MoWR → LGED DPHE + Mymensingh Pourashava → Citizens
		Local Government Implementation (LGI) scale	- Bengal Municipalities Act, 1864, 1938 - Local Self-Government Act, 1885 - Local Government Loan Act, 1879		
Bangladesh	**Evolving policies and institutions (1996-2010)**	Central /national scale	- Environmental Conservation Act' (1995) and rules (1997) - Housing Act 1996 - National policy for Drinking water supply and sanitation, 1998 - National Water Policy, 1999 - Participatory Guidelines for water-based projects (1995/1998/2000) - Millennium Development Goals (MDGs), 2000 - Water supply and sanitation baseline survey, 2003 - National Sanitation Strategy, 2005 - Hygiene Strategy, 2005 - Water and Sanitation Sector Development Plan (2005-2015)	Donor organizations' influence and investment continued to shape State-led formal urban water systems, although DPHE fails to contribute and Pourashava took charge. However, during this period there was an emerging service delivery role for NGOs around water supply and sanitation along with increasing attention towards environmental activist around river water pollution. There are no opportunities for citizen participation although there were policies and strategic direction	LGRD&C and MoWR, Donor organizations (i.e. ADB) DPHE +LGED Mymensingh Pourashava → Citizens Environmental activists → NGOs
		Local Government Implementation (LGI) scale	- Upzilla Parishad Act of 1998 - Zilla Parishad Act, 2000 - Pourashava Act 2009 - Citizen Charter - Pourashava Vision		
	Redefining roles and policy goals (2011-2017)	Central /national scale	- Bangladesh Water Act, 2013 - Sector development plan (2011-2015) - National Water Supply and Sanitation Strategy, 2014 - Gender equity strategy in 2015	Donor organization continue to influence and other central agencies (i.e. UDD) came for collaborative activities for shaping urban water governance regime as multi-level and participatory. NGOs become development partners and continue to work on soft-approaches. Innovation in governance and planning (i.e. UGIIP and MSDP) facilitated citizen participation in decision-making and further to influence regime activities (e.g. town level committees for decision-making).	LGRD&C, MoWR & MoH&PW, Donor organizations (i.e. ADB, CDMP-UNDP) TLCC/WLCC DPHE, LGED, UDD, Mymensingh Pourashava → Citizens Environmental activists Other non-state actors (private/individuals /academic) → NGOs
		Local Government Implementation (LGI) scale	- Pourashava Gender and Poverty Reduction Action Plan - Mymensingh Strategic Development Plan (2011-2031)		

Note: LGRD&C: Ministry of Local Government, Rural Development and Co-operatives; MoWR: Ministry of Water Resources; MoH&PW: Ministry of Housing and Public Work; CDMP: Comprehensive Disaster Management program; UNDP: United Nations Development Program; DPHE: Department of Public Health and Engineering; LGED: Local Government Engineering Department; UDD: Urban Development Directorate; TLCC: town-level coordination committee; WLCC: ward-level coordination committee

As of 2017, Mymensingh Pourashava had the capacity to supply one-third of its total water demand, covering approximately 15 per cent of total households (MSDP, 2015). To supplement water supplies, households typically draw from individual or shared tube-wells and street hydrants, increasing water coverage to 46 per cent of the total population, including informal (slum) communities (MSDP, 2015). For sanitation, approximately 93 per cent of the Mymensingh Poursharva population use some form of latrine, including septic tanks, ventilated and pit latrines (MSDP, 2015).

5.2.1 Formalising and developing the urban water system (1893–1995)

As with Dhaka (chapter 4), Mymensingh has a long history of formalised urban water practices. This is due to its regional importance during the British colonial period as mentioned earlier paragraph. Analysis of media and other secondary data (i.e. collected documents from Pourashava) revealed that the urban water system in Mymensingh was first established in 1893, right after Dhaka (1878). Formalisation of the urban water system in Mymensingh was driven first by the British colonial administration for subcontinental sanitary reform, similar to Dhaka's urban water (as discussed in chapter 4, section 4.1, p. 93). Second, the death of the then king's wife, who succumbed to a cholera outbreak, prompted the king to turn his attention to delivering good-quality drinking water. The King donated a significant amount of money to build waterworks (one water treatment plant and with piped netwrok for small coverage and a few street scale hydrants, here refereed as the niche project/innovation). The urban water niche was named 'Rani Rajeshwari Devi (RR)' waterworks, to commemorate the king's efforts under the regime's focus on delivering improved water quality and sanitation and reducing mortality.

The empirical case data (interview and media) reveal that after the establishment of RR waterworks, Brahmaputra River was the only source for extracting water. However, due to the high cost posed by technical difficulties and maintenance and lack of sufficient storage capacities, development of this niche was unsuccessful despite pressure from the regime. As a result, the Pourashava closed the water treatment plant in 1966. The limited Pourashava water supply records indicate that the total water supply infrastructure included 42 km of pipeline, 782 water connections (largely domestic and a few commercial), and 315 street hydrants with five overhead tanks. An interviewee (Pourashava staff member) inferred that the water supply coverage during this period was only for a number of local elites.

The closure of the urban water niche in 1966 resulted in the introduction of a new actor in the urban water governance system, when the Department of Public Health and Engineering (DPHE),[13] a central agency, took control of drinking-water supply management in Mymensingh city. The DPHE played a significant role in developing the urban water system until 1972, after which the political turmoil in the country weakened its programs and services. After the country secured independence in 1971, the Bangladesh Government sought international support to improve public health outcomes. Based on the recommendations of international development organisations, the water supply in Bangladesh, including Mymensingh, moved to groundwater-based systems (IBRD, 1972). At this time the water management regime shifted and DPHE as dominant actor started to install tube-wells all over the country, including Mymensingh Pourashava. This led to the development of the urban water system in Mymensingh using a groundwater-based water supply system. The Asian Development Bank (ADB) assisted in this development through financial and technical support to DPHE and became a key actor.

While the broader regime focus was on developing small-town water supply and sanitation, initially installing tube-well and building a small piped network became dominant activities by DPHE. DPHE did not engage with the Pourashava to build their capacity. As a result, these niche projects failed to provide the anticipated outcome (similar failures were also observed in other Pourashavas), leading the ADB and the Government of Bangladesh to recognise the need to involve Pourashavas in such activities to improve their capabilities. This prompted the formulation of a new policy for urban management (1994) and shifted regime focus to strengthening Pourashavas' organisational and staff capacities so they could deliver water and sanitation services without DPHE involvement in implementation activities (ADB, 2015). However, there was no significant activity identified by the interviewees during the research period that relates to the 'capacity' issue indicated by the failed niche projects.

During this time period, the actor clusters responsible for urban water governance involved the Pourashava, the DPHE, the LGED (as the controlling authority for Pourashavas) and the ADB. The Pourashava, although the key actor, lacked the capacity to deliver water and sanitation services and the DPHE with the LGED became dominant actors in water and sanitation services. However the central agencies, the DPHE and the LGED, had a different political and

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[13] The DPHE is a central agency under the MoLGRD&C, similar to the LGED and established in 1953.

institutional ideology. The DPHE was focused on developing the water supply system and a few toilets (both public and shared community latrines) as part of the national public health agenda, while the LGED focused on strong centralised influence over Pourashavas' administrative and financial activities (ADB, 2015). Additionally, during this period there was little coordination between these two central agencies, which led to conflicts over decision-making and authorisation of urban water management in Mymensingh. Furthermore, additional pressures and influence were exerted by the international development partners (e.g. the ADB), which further shaped urban water governance strategies in Mymensingh in order to improve local governance capacity, which will be discussed further in section 5.3 (p.123).

5.2.2 Evolving policies and institutions (1996–2010)

As stated in section 5.2.1, although there have been policies directed at improving the Pourashavas's internal capacity (organisational and staff), the on-ground reality did not reflect such policy implementation. Keeping this issue in mind, the government continued to release other relevant policies (Urban Management Policy, 1994; National Water Policy, 1999; Upzilla Parishad Act, 1998; and Zilla Parishad Act, 2000; see Table 5.1) to reduce the policy gap in the capacity of Pourashavas (ADB, 2015). Following this shift in policy, the regime supported advancing political decentralisation and conferred a level of financial authorisation (2004) onto local government institutions (LGIs) (Bangladesh Local Government Acts and Rules, 2015). Such regime change opened opportunities for political decentralisation, though the change remained largely inactive:

> The Government has long been aware of the rapid pace of urbanization and the associated physical, economic, and social problems, it has not yet been able to approve a comprehensive urban policy. The Urban Management Policy Statements (1994 and 1999) prepared by the Local Government Division (LGD) emphasized that all pourashavas should have adequate personnel and financial strength, provide and maintain infrastructure, implement land use plans, address poverty, ensure participation, and involve the private sector. These policy statements, however, were not enacted. (ADB 2009, p. 8)

This continuing gap in policy translation was also reflected in interviewees' examples of other failed niche projects in Mymensingh and other Pourashavas. The secondary city water supply and sanitation project (2006–10) in Mymensingh was designed and implemented by the DPHE with support from the ADB, where Mymensingh Pourashava was largely responsible for running the project. However, the Pourashava failed to run it, because the staff were not

familiar with the technology that the DPHE installed. The same thing had happened in other Pourashavas where the project had been implemented.

This recurring failure of niche projects indicated that the regime had failed to provide actors with the knowledge and technical skills required for the projects (installed water supply system). This meant the anticipated outcomes were never going to be achieved. However, interviewees pointed out that they had raised these issues with their higher authority and donor agencies (i.e. the ADB), which led to several joint studies (central agencies and ADB). The findings from the studies shaped the formulation of the Pourashava Act (2009). This act is focused on improving the capacity of local institutions, Pourashavas (individuals and organisations); to build the skills and capacity needed to ensure a smooth delivery of basic water supply and sanitation services. Interview participants had very positive responses towards the Pourashava Act (2009) and indicated it had influence over their conventional management approach. The interviewees pointed out that with this act, the Pourashava and other Pourashavas were no longer under the control of the DPHE and/or the LGED. Rather, they felt empowered by having a platform to make their own decisions while enjoying some form of financial autonomy. Here financial autonomy reflects how Pourashava's have authorization to make investments, approve annual budgets, revise/levy tax rates/fees/tools, and undertake projects from their own funds, or how they can directly receive grants from donor organisations:

> Before this Pourashava Act, we feel like we are middle of these two central agency (DPHE and LGED). These two do not talk to each other and there are no clear instruction of what their authority over our initiatives. Most of the time we cannot meet our deadline as there are always dilemmas on signatory authorisation. (Senior manager, Mymensingh Pourashava)

The formulation of the Pourshava Act (2009) was also the outcome of broader regime change experienced by the water sector as it followed international discourses on the adoption of IWRM[14] into the National Water Policy (NWP) (1999), revision of participatory guidelines for water related projects (2000), the Millennium Development Goals (MDGs),[15] the Environment Protection Act (EPA) of 1995 (see Table 5.1). Indeed, one interviewee stated that with the enactment of the EPA, they started to address the 'Brammapurta River pollution and untreated sewerage dumping into and on the banks of the river' and raised their voice against pollution.

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[14] Integrated Water Resource Management.
[15] MDGs: Bangladesh became a signatory of this initiatives right after its launch in 2000.

As part of their initiative they organised rallies and seminars and questioned Pourashavas' capacity to resolve such issues. This indicates an emergence of environmental activists as another actor cluster (see Table 5.1) and they gained greater influence over the approach to urban water governance.

This period saw regime-driven changes in urban water governance in Mymensingh, and for the first time in history, Pourashavas were engaged with decision-making processes and had financial autonomy. This period also experienced critical engagement of other actors, including environmental activists who have had some influence over urban water system. Overall, this time period demonstrated (i) an evolution in the policy and institutional contexts associated with urban development and improving urban water service delivery, and (ii) recognition that the capacities of local state agencies required attention. Moreover, new discourses, interests and an emerging social movement towards environmental conservation (i.e. drinking water security and quality; restoring river quality, saving urban wetlands and green spaces) started to influence national strategic directions and policy goals, despite strong centralised control over the urban water system.

Together, these policies and innovative strategic guidance supported the development of other niche projects that are closely related to the urban water niche. In light of these regime changes, different development partners began designing and implementing water and sanitation projects aimed at small town development and reducing river water pollution. This seeded the initial the ADB-funded Urban Governance and Infrastructural Improvement Project (UGIIP), a new niche project in Mymensingh and forty-seven other Pourashavas. The project is unique and new-to-context (i.e. in a secondary city) for Bangladesh due to its significant attention towards improving Pourashavas' governance capacity in leading water supply and sanitation services as well as keeping river water clean by developing drainage networks to manage sewerage and storm water discharge.

5.2.3 Redefining roles and policy goals (2011–2017)

The evolving urban water governance regime in Mymensingh resulting from key policy and institutional changes prompted major governance reforms and enabled diverse actors' engagement at multiple levels of implementation. The Pourashava Act of 2009 and UGIIP project implementation in Mymensingh city led to innovative strategies to drive a shift towards

a hybrid structure of governance, which refers to the combination of aspects of hierarchical, market and network approaches (van de Meene et al., 2011). Several scholars argue that this hybrid structure is likely to be more available in the complex real-world situation (Pierre and Peters, 2000; Meuleman, 2008). Environmental governance scholars reflected on this hybrid governance approach and indicated it has more potential to deliver sustainable outcomes (Kooiman and Jentoft, 2009; Lemos and Agrawal, 2006; Pahl-Wostl, 2009; van de Meene et. al., 2011). Van der Meene et al. (2011) explained that the hierarchical approach in the hybrid structure is beneficial to supporting the formal administrative authorisation, political leadership and sanctions, whereas the network approach is beneficial for flexibility in implementation and supporting informal activities facilitating collaboration, learning and innovation, and the market governance approach facilitates efficient resource use, providing incentives and stimulating industry participation.

In Mymensingh, this hybrid structure of governance engages several actors and agencies at national/central scale (i.e. DPHE, LGED, DoE)[16] and a few more at city-scale/local scale (i.e. Pourashava, committees at city and ward level known as TLCC[17], WLCC[18]); all functioning through an institutional hierarchy with some administrative decentralisation (see Figure 1 for details). Here the decentralised schemes have some form of polycentric characteristics,[19] as they transfer decision-making and financial autonomy to local scale actors by embedding them in the Pourashva's management system with other relevant actors (i.e. DPHE, LGED) (Table 5.1 and Figure 5.1).

The actor clusters (TLCC, WLCC, CBOs)[20] typically consist of local community members and representatives from NGOs, and environmental activists (further details of the structure and processes of their operation is described in page 128). This shift to a hybrid governance structure in Mymensingh is creating an increasingly complex dynamic among the actors and in institutional arrangements. This shift is new in the context of local government agencies in Bangladesh and this opened a platform for participatory decision-making by forming new networks of diverse actors (Table 5.1 and Figure 5.1). However, shifting towards a hybrid and

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[16] Department of Environment under the Ministry of Environment, Forest and Climate Change.
[17] Town level coordination committee.
[18] Ward level coordination committee.
[19] 'Polycentric characteristics' refers to having many centres of decision making in a resource governance structure. See further in chapter 2/Publication 1; Cinner et. al., 2012; Huntjens et.al., 2012.
[20] Community-based organisations.

polycentric governance structure in Mymensingh now raises the question of how these practices are contributing to developing adaptive capacity. This requires further analysis of the governance structure, relevant actor clusters and their activities at multiple levels of implementation.
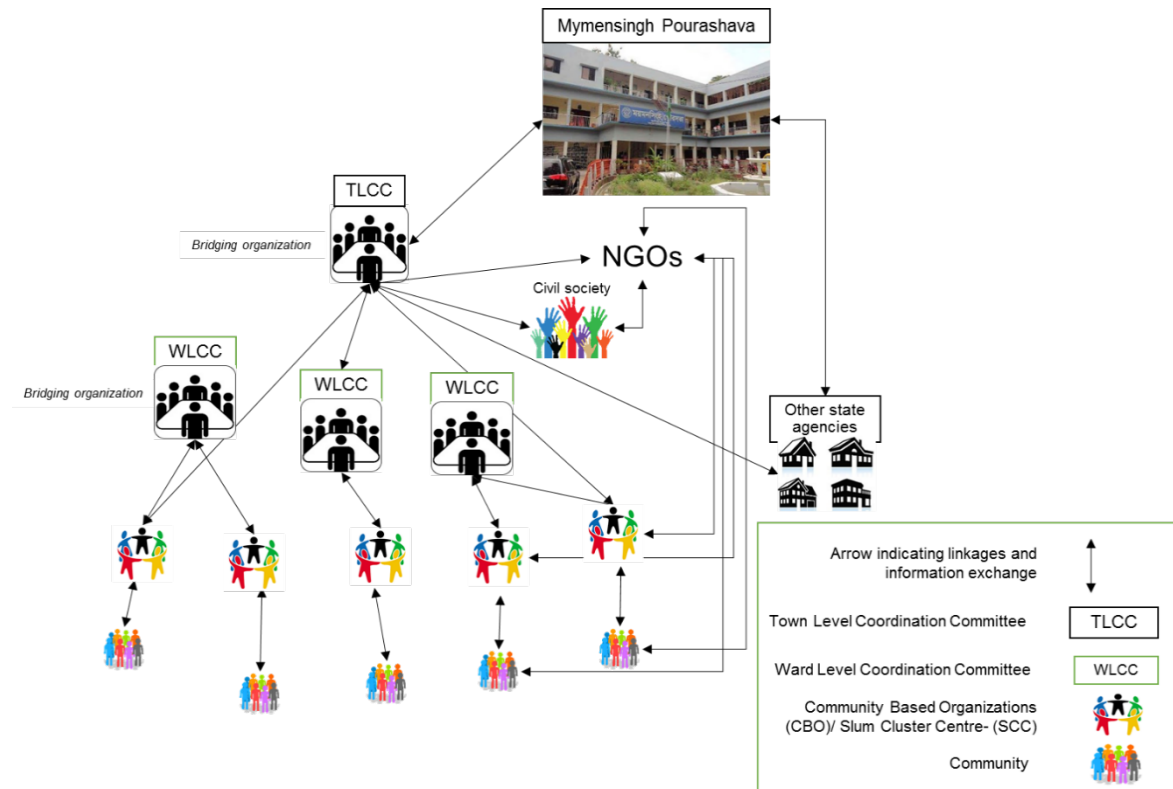
Figure 5.1 Schematics of actor clusters and their scales in Mymensingh city development initiatives

In this context, the Mymensingh Strategic Development Planning (MSDP) was established as a niche project (2011–15). The MSDP was a pilot, designed to facilitate national collaborative efforts to increase the community's capacity to be able to engage in future city planning. The MDSP project drafted a twenty-year master plan to guide sustainable development in Mymensingh. Within the data collection period of this research, interviewees spoke highly of these two projects, identified the new period for Mymensingh city, and indicated a key focus on improving governance capacity for actors with greater influence over the delivery of water sanitation services in Mymensingh. The following section will further analyse and discuss how related innovation and strategic guidance emerging from implementing these above-mentioned two key niche projects is contributing towards developing adaptive capacity by using the ACA framework developed in chapter 2 (p. 53). This will build an understanding that is needed for advancing sustainable urban water management in Bangladesh.

5.3 Increasing adaptive capacity in Mymensingh's urban water system

As outlined above, significant changes have been observed in the regime, where the contribution and influence of the transnational actors (e.g. The ADB, UNDP) is very prominent in Mymensingh. The identified niche projects, UGIIP and MSDP were designed and implemented by following the strategic and financial guidance developed by these transnational actors to improve the institutional and actors' capacity at local level. Table 5.2 presents the identified synergies as well as some form of tensions in the two projects related to their vision, implementation approach, key focus and nature of lead actors' involvement. As mentioned in section 5.2.3, the activities through UGIIP and MSDP have been driving a shift towards developing a hybrid system that also shows some form of polycentric characteristics, creating opportunities for participatory and network activities through nurturing bridging organisations and leadership capabilities. All these align with attributes in the ACA framework and act as enablers to support activities for improving adaptive capacities to advance sustainable urban water management (SUWM) (chapter 2, p. 38-60). In light of such understanding the section below takes further the analysis of these enablers and discusses how they are contributing to an increased level of adaptive capacities of Mymensingh's urban water governance system to support sustainability transition.

Table 5.2: Synergies and tensions between the UGIIP and MSDP projects in Mymensingh

CRITERIA	UGIIP PROJECT	MSDP PROJECT	Synergies	Tensions
Implementation period	2009-2014 (Phase-II) (*Phase-III will commence from 2017)	2011-2015	-Share diverse range of resources delivered though the projects' period (i.e. different reports and learning outcome) -A common pool of local actors (i.e. MDSP identified potential actors those are already involved with the UGIIP project therefore already developed some form of capacity in understanding complex problems within urban boundary)	With UGIIP project activities already in execution, it was difficult for the MDSP team to facilitate communities' involvement for identifying disaster risk related activities in city planning, not the infrastructural development for city development.
Lead actors	Local Government Engineering Department (LGED), Department of Public health and Engineering (DPHE) and Mymensingh Pourashava	Comprehensive Disaster Management Project (CDMP) - UNDP Bangladesh and Urban Development Directorate (UDD)		Different agencies with different mandate make it difficult to collaborate.
Vision	Improved municipal service delivery and urban governance in project towns and strengthen pro-poor and gender-responsive urban governance	Developing a 20-year of a master plan for Mymensingh pourashava and surrounding areas to build pourashava's capacity to envision their city's future resilience.	Emphases on developing Pourashava's governance capacity to be able to deliver improved services (i.e. water supply and sewerage /storm water management; establishing water reservoir for water security)	UGIIP project largely deal with hard-approach (building drains, piped networks) whereas MSDP is more onto soft-approaches (planning and community resilience). While there are scope for complement, however in reality UGIIP already is in implementation whereas MSDP developed a master plan that awaiting formal approval, therefore it is difficult to support each other's implementation processes.
Implementation approach	Sectoral, participatory and inclusive governance approach towards where communities representation in decision-making and authorization.	Bottom-up urban planning approach with wide-range of the community to point out the key problem and identify possible solutions.	Both of the projects instigate participatory learning and implementation	UGIIP project has some pre-planned activities that were little different from the MSDP master plan, resulting in confusion over implementation
Focus	Developing partnership between and among govt., development partners and other key sector stakeholders to broaden government and national ownership over public sector policy and resource allocation within the sector.	Developing communities resilience through increasing formal and informal participation and collaboration between government efforts with other government agencies and also with other non-government organization and civil-society for sustainable development of urban areas and ensure basic service delivery to the people.	Developing partnership between and among diverse range of stakeholders aiming to ensure equal distribution and access to resources.	UGIIP is focused on developing capacity of the state actors whereas MDSP is focusing on developing communities' capacity to be involved in risk reduction processes.

5.3.1 Hybrid governance with polycentric characteristics

The hybrid and polycentric governance structure in Mymensingh Pourashava is creating a significant influence over the relevant institutions and actor interactions at both central and local levels and is offering critical space for their participation into decision-making processes. According to interviewees, new actor clusters (i.e. TLCC/WLCC) are involved in decision-making broadening their capacity for implementation of both UGIIP and MSDP (see Table 5.2) through collective efforts. The ACA framework indicates such participation is important for integrating the polycentric governance approach and emphases it as an alternative to traditional top-down, state-driven approaches. Polycentric governance develops the capacity of non-state actors and ensures their participation in decision-making at multiple scales of implementation (Azhoni et al., 2016; Clark and Semmahasak, 2013; Newig and Koontz, 2014, see further details in chapter 2).

In Mymensingh, such emerging polycentric governance in the hybrid structure provides broader opportunities for non-state actors to be involved in Pourashava activities and to adopt a participatory approach for developing a shared vision and facilitating learning outcomes. The ACA framework identifies these as key adaptive attributes for advancing SUWM. For example, during the interviews, Pourashava staff indicated that with developing an underground drain, the implementation team waited for the collective consent of the TLCC. If the project design is not approved by the TLCC, they cannot start implementation, as the community will not accept it. Pourashava staff added that communities know their water-logging situation and the causes of it best as they have been living there for a long time, while Pourashava staff are not necessarily from the local community (Pourashava service requires transfers from one Pourashava to another over their service period).

Further, interviewees indicated that this hybrid governance structure and its polycentric nature created an opportunity for local communities to participate and exchange information and raise awareness about mechanisms and practices to help the city of Mymensingh become more sustainable and healthy. For example, regular activities such as yard meetings[21] to share updates in the TLCC/WLCC member groups contributed to increasing community awareness

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[21] Yard meetings are usually facilitated by the local NGOs and more often by the community leaders with a small group of people (12 to 15) where they discuss issues such as sanitation and hygiene, reproductive health, children development and many more based on the NGOs key focus area.

about personal and environmental health and prompted an aspiration for healthy living standards, including in informal settlements (slums). Figure 5.1 clearly indicates the nature of the relevant actors' participation and how these connected actors are contributing to the flow of information and knowledge exchange across them. For example, TLCC activities fed through the discussion and information exchange in WLCC (ward-level coordination committee) meetings. Such exchange of information through these types of overlapping committees is necessary for delivering bottom-up thinking with the traditional top-down strategies, a development that scholars indicate is important for sustainable delivery of services (Ahammad et al., 2014; Azhoni et al., 2017; Biggs et al., 2013; Larson et al., 2013).

Further, the overlapping membership and integration of knowledge are important adaptive attributes (Figure 5.1) that are critical for strengthening communities' capacity to support a sustainable system. This integration of knowledge builds management capacity and initiates innovative ideas. For example, an interviewee pointed to a specific location in the city area where the drainage system was designed and developed using input received from the local community that reduced the problem with stagnant water. Another example provided by another interviewee related to the installation of submersible pumps for a shared water supply facility in a slum, an idea that came from that slum community, as they were aware that finding a suitable space for installing tube-wells was critical in densely populated areas such as slums. While these innovative ideas might not solve at once the problems associated with urban water services deliveries in Mymensingh, they indicate steps towards increasing the capacity of the relevant communities to think about alternatives suited to their socio-ecological context. They also have the potential to strengthen communities' self-organising capacity and to develop trust among state and non-state actors. Self-organisation capacity and trust were identified in the ACA framework as important adaptive attributes.

Prior to the governance shift to a hybrid and polycentric structure, the Pourashava council (consisting of the mayor and councillors) under the central agency the LGED had sole access to and authorisation over resource distribution and management. Although the success of the council largely depends on the elected members' leadership capabilities, interviewees raised some criticisms. They mentioned there was distrust and differences in political beliefs and agendas among the elected members and the local state actors, which often led to conflict in decision-making. The communities were disconnected from the decision-making processes and

this raised distrust and some accountability issues between communities and local state actors including elected members. This is illustrated by the quotes below:

> Before these committees (TLCC/WLCC), the Pourshava staff always made excuses for their bad services. More often they did not deliver the promised services and sometime demanded bribe. Now things are changing and Pourashava staffs are changing their behaviour. (Local community member) [Interviewee quote 2]

> Our mayor's door is always open for us. We can enter his office whenever we want and make complaint about the Pourashava services. Before him, no other mayor opened this door for us. (Social activist, Mymensingh) [Interviewee quote 3]

Including different level actors clusters (TLCC/WLCC) within the Pourshava governance structure created this opportunities for broader community participation and increased the chance for raising their voices against the issues of distrust and lack of accountability. A couple of interviewees mentioned the TLCC's mandate of producing yearly report cards that showcase the development and achievement by the Pourashava and citizen charters and these should be displaying in the Pourshava premises in order to improve accountability and visibility:

> Citizens should know what we are doing otherwise they will not be convinced. They elected us (mayor and ward councillors) for doing something beyond their expectation to change (in a positive way) the current scenario. They want to see the future where we can provide the quality services to the citizen. (Ward councillor, Mymensingh Pourashava) [Interviewee quote 4]

5.3.2 Bridging gaps and steering new network formation

The TLCC and the WLCC were identified in this research as bridging organisations (enablers) and were referred to as a 'timely' and 'useful' initiative by interviewees. These committees achieved some successes in bringing different actors to a single platform to discuss and agree upon viable options to address their problems in relevant city-building activities. In analysing the critical interactions and connection at multiple scales, as presented in Figure 5.1, it is evident that these actor clusters are crucial, first for stimulating new linkages; second, for strengthening the overall capacity for knowledge sharing and accessing resources; and finally for promoting collective efforts through formation of new networks (both formal and informal).

All of these are important adaptive attributes identified by the ACA framework to encourage co-production of knowledge for enabling adaptation strategies to reduce vulnerabilities (Kuzdas et al., 2015; Sowman and Raemaekers, 2018;). A community member's comments on their own efforts with resource use and maintenance indicate an increase in communities' responsibilities to reduce vulnerability and uncertainty:

> Nowadays we do not always bother Pourashava people, they have lots to do; when there are blockages and dirt in our drains, we try to clean them ourselves so that natural drainage can work, otherwise it simply starts to overflow and become all smelly and a breeding place for mosquitos and pollutes our environment. (Local community member) [Interviewee quote 5]

The TLCC is referred to as a 'mini-parliament' by interviewees, where communities feel empowered and aware of their city's development activities.

> The TLCC acts as a guide for our community. Together we identify problems, seeks necessary solutions, discuss the barriers, and advocate on how to overcome those barriers. (A leader of the TLCC and Mymensingh Pourashava) [Interviewee quote 6]

> I am a member of TLCC and not a yes person, I always say what I believe will bring good for my city. I will not allow throwing our dirt in drains anymore, now I understand we are responsible for our actions. I always raise my voice in the meetings (TLCC) against all sorts of pollution problems. (Civil society activist) [Interviewee quote 7]

At the time of interviewing, the TLCC was headed by the mayor and included thirty-three diverse professionals groups (e.g. teachers, journalists, NGO professionals, other state authority representatives including the Pourashava administrative head and ward councillors), and lower income group representatives (a member of slum groups). The TLCC often discusses and frames recommendations regarding the diverse issues influencing Mymensingh city development. This includes the mode of water supply (piped water or tube-well or submergible pumps) and coverage, drainage system design and development, waste disposal methods and overall environmental sustainability. For example, improving the drainage system to develop a solid waste disposal system involved state and non-state actors (three local NGO, one international NGO and one research and education institution). While the TLCC guided the overall collaboration, this initiative provided a significant example of new niche innovation. Through this collaborative intervention, new organic manure from sewerage waste was developed for

the local farmers; new market linkage established and secured a connection between rural and urban development.

The actor clusters (TLCC/WLCC/CBOs) were very prominent and active during the UGIIP project implementation period. However, they became less productive and subsided after the project completed its second phase:

> Previously we met once a month, now that we do not have a project, the process became slow, this is how it goes when we do not have funding, however, still we are meeting once in three or four months' time. (Local community representative) [Interviewee quote 8]

Interviewees identified the absence of financial support and relevant project activities as being responsible for the slower progress in TLCC and WLCC' activities. However, they also pointed towards key local actors' (e.g. the mayor) contributions, in particularly facilitating TLCC meetings, being open to innovative ideas, and developing strong communication and networking skills. These local leaders showed a promising and positive attitude in their efforts and contributed to Pourashavas' activities to maintain good water quality and drainage improvements in the Mymensingh city area. For example, most of the interviewees (85% of respondents) praised the city mayor for his interest and dedication to TLCC activities and stated that although the TLCC is a project-based activity, the mayor is using this platform for important decision-making and seeking regime guidance from sector experts on solutions.

Nevertheless, community leaders who were interviewed (20% of the interviewee) consider themselves removed from the formal decision-making processes that influence Pourashava activities and suggest that this is due to their political stance (they belong to the opposition party, not the current ruling party). Local community leaders raised their frustration regarding the formal decision-making processes as 'project dependent and short term, and let's see how long it is going to survive' (Interviewee quote 9). A few interviewees pointed to this critical context of leadership capability and urged training for grassroots leaders to enhance sustainable water management.

The activities by the actor clusters (TLCC/WLCC) in the hybrid and polycentric governance structure in Mymensingh are providing opportunities for multi-level interactions, community participation and bridging activities for policy implementation. While these are identified as contributing to local governance capacity, challenges remain at other administrative levels,

such as the regional and national levels. These actors are still dominated by a top-down approach that lacks bridging capacities and coordination between central agencies. Such problems have persisted for a long time in Bangladesh and in many other developing countries (Cinner et al., 2012; Nguyen et al., 2017; Satumanatpan et al., 2014).

In this context and as an alternative to the top-down approach, the MDSP initiates bottom-up strategies in city planning and acts as a bridging organisation. This niche project is designed to bridge national and local-scale state agencies. The MSDP staff interviewed stated that they are very excited about their project, which is producing a manual to guide different agency activities at the local scale:

> The MSDP project is a first of its kind as a collaborative project between two national-level state agencies to understand how to integrate and translate planning into practice. (MSDP team member) [Interviewee quote 10]

As Table 5.2 shows, the MSDP involved state and non-state actors, including those already engaged with the UGIIP project, as well as new relevant actors. MSDP activities involved focus group discussions with relevant professionals and experts with the aim of sharing knowledge and opinions related to future city planning, including collectively agreeing upon problem identification and discussions related to possible solutions. MSDP is described by an interviewee as 'a unique approach due to its emphases on community involvement as part of facilitating bottom-up strategy' [Interviewee quote 11]. Over the duration of the project, the MSDP team undertook forty-two distinct field visits, held several workshops, seminars and group discussions. The reason for such diverse consultation is to make the community familiar with the project's targets and the relevance to Mymensingh city's ongoing development.

While sharing field experiences during research interviews, members of the MSDP planning team acknowledged the enthusiastic participation and support of the relevant non-state actors (i.e. TLCC/WLCC/CBOs) but also vented their frustration with what they perceived as inadequate participation and collaboration by other state actors, such as government agencies. The challenges confronting state agency involvement was identified by interviewees as i) lack of coordination across state agencies; ii) bureaucratic delays and complex decision-making processes at national level; and iii) distrust across state agencies (evidenced in quotes). After finalising the plan, the MSDP team developed a model to showcase their plan output and this received wider acceptance from the citizens. Although this project is still waiting formal

government approval, the Pourashava authority has already started to use this document as their vision and guidance for future development.

Table 5.3 summarise the understanding of the enablers and emerging adaptive attributes identified in this research using the ACA framework. The next section will further elaborate on how these enablers are providing a useful platform for developing capacity to deliver adaptive attributes and guide sustainable transformation pathways in Mymensingh.

Table 5.3 Enablers and emerging adaptive attributes identified in the ACA framework in Mymensingh urban water governance

MYMENSINGH URBAN WATER GOVERNANCE		
ENABLING CONTEXT	Relevant examples, quotes and closely related adaptive attributes	**EMERGING ADAPTIVE ATTRIBUTES**
Hybrid Governance with polycentric characteristic (Section 5.3.1)	-Actors clusters at multiple levels of implementation. *(e.g. TLCC/WLCC)* **[A, B, C, E]** -Participatory decision-making processes for city development activities *(e.g. 20-years of master plan for city development includes participatory planning approach and integration of disaster-risk-reduction strategies, Interviewee quote 6).* -Decision-making and financial autonomy directed towards local authority, which includes wider community involvement. *(e.g. developing the capacity of the non-state actors to raise their voices over their preferences, which indicates some level of flexibility in decision-making processes despite strong centralized control, Interviewee quote 7).* -State and non-state actors' participation in policy translation. *(e.g. TLCC/WLCCs from UGIIP project, Interviewee quote 5).* **[B, C, D, E, F, H, G]** -Increasing levels of trust observed upon state actors and local leaders. *(e.g. displaying Pourashava vision and producing yearly citizen charter, Interviewee quote 2)* **[H, I, N]**	A. Layered/multi-level B. Participatory approach and in the processes of new network formation C. A combination of top-down and bottom-up approach. D. Diverse actors base E. Power transfer F. Flexibility in decision-making G. Integrated approach in city development H. Trust and fairness I. Shared goals and vision J. Diverse and interconnected knowledge base K. Formal and informal activities L. Coordination and collaboration M. Linking N. Bridging gaps O. Championing
Bridging organisation, network formation and leadership (Section 5.3.2)	-Displaying Pourashava vision and citizen charter at Pourashava premises indicating developing shared understanding and motivation for change. *[Interviewee quote 12]* **[H, I]** -Different layers of decision-making committees displays overlapping memberships, which encourages a base of diverse knowledge and sharing *(e.g. Figure 1).* -Increasing scope for knowledge generation and mobilization observed which further increased opportunities for information sharing. *(e.g. TLCC/WLCC/Yard meetings, 20-years master plan, Figure 1)* -Diverse actors clusters are offering a platform to capture community preferences into state driven activities and linking diverse knowledge base into policy implementation *(interviewee quote 6 and 7)* **[D, J, K]** -Formal activities and informal activities traced in support to delivering water and sanitation services to the citizen, where informal engagement found more broad and effective than the formal system. *(formal activities such as, augmentation of piped network, water connection in informal settlements, and informal activities, such as, NGOs driven initiatives for solid waste collection for reducing blockage of drains, several initiatives by the social activist for reducing river water pollution, handwashing programme in schools).* **[K]** -Some examples of collaborative efforts across state and non-state actors evidenced as played a crucial role in bringing innovative ideas and approach to support sustainable urban water-related practices with occasional coordination *(e.g. TLCC driven collective action for solid waste disposal system and manure production)* **[L]** -Capacity development initiatives started to target state and non-state actors. *(e.g. UGIIP, MSDP)* **[D, J, M]** -Although strongly centralized approach still exist with little scope for local institutions, increasing awareness and capacity started to influence policy implementation and accessing resources *(Interviewee quote 6 and 7)* **[E,F, N]** -TLCC/WLCC/MSDP emerging as a bridging organization and reducing gaps between community and local implementing authority *(Interviewee quote 6, 7, 10 and 11).* -Some leaders are observed as championing change at a different level of implementation and further creating opportunities for local leaders to support sustainable initiatives *(Interviewee quote 3 and 5)* **[M,N,O]**	

5.4 Capacity development and pathways

Three major governance reforms since the inception of the Mymensingh urban water system in 1893 to 2017 were identified utilising the MLP as an organising framework to differentiate between niche and regime projects or activities (Table 5.1). These governance reforms unfolded against a background of three corresponding socio-political contexts in Bangladesh, described in chapter 4, and contributed to shifting and shaping the urban water management in Mymensingh. The governance approaches in each three developmental periods have distinct characteristics and interlinkages across institutions and actors (see Table 5.1) and began differently than the dynamics in Bangladesh more broadly (Dhaka in particular). Although Mymensingh has a different 'starting line' to Dhaka, its urban water development was similar to broader Bangladesh's regime-driven urban water development until the recent implementation of the niche projects (e.g. UGIIP and MSDP).

The first developmental period (1893–1995) in Mymensingh saw major institutional setups where key actors (i.e. Pourashava, DPHE and LGED) were facing tremendous challenges in the delivery of water and sanitation services. These challenges stemmed from 1) different institutional ideologies and a lack of coordination between the central agencies; 2) the Pourashava was not involved in the capacity development initiatives, and 3) transnational actors (e.g. ADB) had a dominant influence without adequate knowledge of the implementation context.

In the second developmental period (1996–2010), Mymensingh experienced a major reform in the institutional and actor space, where for the first time in the history of Bangladesh, Pourashavas were involved in the decision-making processes and started to enjoy some level of financial autonomy. In the institutional space, this period saw the formulation and implementation of relevant policies, legislation and plans (see Table 5.1), which were key to involving Pourashavas as the major implementation authority and engaging them in the capacity development initiatives. Further, this evolution in the institutional space also supported other developments, such as social movements concerned with environmental conservation and water security, concern about river-water pollution and wetland conservation for urban water drainage. Together these changes in institutional and actor space created a platform where innovative projects such as UGIIP and other urban water and sanitation related projects started to shape Mymensingh's urban water system.

The contemporary development of the urban water system in Mymensingh (2011–17) is distinct and shows several niche innovations that may guide future developmental pathways. The ACA framework identified the institutional rearrangement and formation of new actor clusters (see Figure 5.1) through niche projects, which are shaping Pourashava's governance system into a more hybrid form. These niche projects are also supporting the development of polycentric characteristics, in which decision-making and financial autonomy have been directed towards local actor clusters, involving state and non-state actors. This hybrid governance approach is reflected in the academic literature as having the potential to advance SUWM implementation (Brown et al., 2009; Clark and Semmahasak, 2013; Kuzdas et al., 2015; Pahl-Wostl, 2007).

The emerging hybrid and polycentric governance structure in Mymensingh are acting as the key enabler to support sustainable change and creating platforms to facilitate complex interactions among engaged actors (both the state and non-state) to develop necessary connections and linkages and overall in the processes of forming new networks. These complex interactions and diverse actors' engagements and new networks are found by adaptive governance scholars to be important enabling factors for facilitating collective effort, integrating local knowledge and raising awareness and critical for operationalisation of adaptive governance principles and thus can support advancing SUWM (Table 5.3; see further details in chapter 2).

Although quantitative analysis of the networks' centrality and cohesion is beyond the research scope, the network formation and increasing informal engagements identified in this study appear to be facilitating active participation and collaboration. The solid-waste disposal and production of manure as an output through coordinated activities driven by the NGOs and research institute is an example of innovation and informal activities in Mymensingh. Such activities have also proven important for cross-scale learning, developing a shared vision and building self-organising capacity, as indicated in the literature (Butler et al., 2014; Larson et al., 2013; Orchard et al., 2015). A number of other examples mentioned by the interviewees are indicating increasing level of policy translation by the local and international NGOs and are actively contributing in awareness raising and capacity development including slums and rural areas.

Fairness in resource access and distribution, accountability of state actors, increasing trust between state and non-state actors are identified in the ACA framework as important adaptive attributes for developing capacity to advance sustainable resource governance. In the case of Mymensingh Pourashava, their initiatives and the newly developed polycentric actor clusters (TLCC/WLCC/CBS) are creating pressure on the implementation authority to ensure accountability and fair access to resources (e.g. need to display report cards in pourashava premises) (Table 5.3). This indicates a restoration of some level of trust to the state actors and a redefining of the boundaries of authorisation and power over resource access and management.

Nevertheless, the hybrid governance structure in Mymensingh is project dependent (UGIIP) and requires financial investment and strategic guidance from the transnational actors (e.g. the ADB, UNDP). Sustainable transition and adaptive governance scholars have found the impact of transnational actors to be important. For example, local capacity formation (Bell and Pavitt, 1993; Nastar, 2014, Panditharatne, 2016), dealing with informal institutions and with weak formal institutions (Bahaudding et al., 2016; 2014; London and Hart, 2004; Orchard et al., 2015; Rouillard et al., 2014), leapfrogging theories (Pousties et al., 2015; Watson and Sauter, 2011). However, this present research did not explicitly identify the contribution of transnational actors, but rather critically examined the projects that were designed and implemented in Mymensingh with their support. The research found that these donor-dependent niche projects and associated actor clusters are creating a promising platform to deliver adaptive attributes such as those framed by the ACA to increase the level of capacity (see Table 5.3). Although donor support was absent for a while, a few TLCC and WLCC meetings were organised and facilitated by key local leaders of Mymensingh city and the councils were involved in the Pourashava's activities with other projects, such as the MSDP (a niche).

The UGIP actor clusters created different platforms (TLCC/WLCC/Yard meeting), which acted as a quasi-formal site for knowledge generation, sharing and integration, while the MSDP platform facilitated and supported the integration of local and scientific knowledge to define local-scale problems and solutions. In turn, these collective platforms helped to reshape people's perception of development and the services they offer. For example, developing a Pourshava Master Plan through the MSDP project, using a demand-driven approach, is itself an example of 'learning-by-doing' (MSDP completion report, 2016). In interviews, MSDP

team members reflected upon their learning experiences; for example, 'fascinating and definitely learned innovative ways of urban planning' (MSDP staff member) [Interviewee quote 12]. Over the course of the project, there were a number of interactive workshops and group discussions where citizens discussed their problems, recommended possible solutions and finally prepared a priority list for implementation. Key challenges facing the community were identified as vulnerability to earthquake hazards, urban flooding due to drainage congestion and groundwater depletion. Based on the community's input the emphasis of this plan was to identify potential sites for reservoirs and to design future infrastructure that can withstand earthquakes.

The changes observed in governance approaches and actor interactions (tables 5.1 and 5.3) using the understanding developed through the MLP and the ACA framework indicate increasing adaptive capacity in Mymensingh Pourashava. However, the issue of effective functioning and advancing sustainable delivery of urban water-related services depends also on institutional rearrangements or functioning at other policy levels. For example, DPHE and LGED both are very crucial for Mymensingh Pourshava and therefore how these two agencies are functioning and collaborating with each other is important. While there has been increased coordination and collaboration observed at the local scale, there remain gaps at the agency level where they are facing challenges in effective coordination with each other, in order to address the unique problems faced in Mymensingh city.

However, DPHE and LGED (the two most central actors in the regime, responsible for providing support for water resource management for pourashavas) have little coordination with each other. As mentioned previously (page 117 and 118) these two organisations have different political and institutional ideology and more often bureaucratic complexities hinders their ability to work together. Although 'lack of coordination' and 'fragmented institutions' are identified by many scholars as a persistent problem for sustainable water management (Azhoni et al., 2016; Butler et al., 2014; Cinner et al., 2012; Falk et al., 2009; Grady et al., 2016; Pahl-Wostl et al., 2012), this provides an opportunity in Mymensingh for an integrated approach to governance 'that offers an appropriate mix of local and regional institutions, with strong support for strengthening of these local institutions by national authorities' (Chan, Roy and Chaffin, 2016, p. 13). This was apparent in the way the structure of water governance changed across implementation levels and significantly influenced the city's water supply and sanitation

system. For example, MSDP's innovative approach for planning, small-scale decentralised water supply system in slum communities.

It appears that these niche projects have not only generated learning opportunities but also supported activities that enable the community to influence state decisions. However, there remains the challenge of effective integration of community preferences into policy implementation, since Bangladesh is dominated by a rigid centralised approach. According to interview participants, although the Pourashava is now ahead in their city development planning (e.g. drainage networks, wetland management) it now involves not only NGOs and citizens but also experts and professionals in formulating their plans. However, a persistent challenge appears to be the absence of guidelines on how to execute these plans. 'Mymensingh Pourashava now has wonderful planning; but I am not convinced that they have necessary capacity to execute these plans.' (NGO worker) [Interviewee quote 13]

5.5 Summary

This chapter has presented an analysis of Mymensingh, a secondary city, focusing on its water sector development, where new institutional arrangements and relevant actor clusters are shaping the progress of the urban water service delivery system. The chapter showed that Mymensingh city is experiencing a shift towards hybrid and polycentric governance, new network development, shared experiences and emergent learning processes designed to contribute to policy formulation and implementation. However, there remains a lack of critical knowledge and guidance to further its adaptive capacities.

In addition to being evolutionary and 'new-in-context' for secondary city development, UGIP and MSDP initiatives are considered examples of innovation and promising pathways to support a shift towards a new governance model. This new model exhibits hybrid and polycentric institutional arrangements, which, along with other critical adaptive attributes presented in Table 5.3, are important for leading sustainable water resource management in a developing context. Prior to the UGIP and MSDP projects, the Pourashava's citizens were mostly responsible for their own water supply and sanitation. While the overall situation of water management has not yet improved and was still in a primitive stage during the research period, a significant change in people's attitudes (citizens and state actors) was observed.

Citizens, including those in slum communities, are more aware of their physical and ecological health.

This change in the actors' dynamics reflects a redefinition of the ongoing hydro-social contract between government and citizen, in which the government is shifting away from its traditional role of being solely responsible for water-related services, and non-state actor's participation is increasing and starting to influence state water-related activities. Citizens of Mymensingh have recognise d their power and capacity to influence state activities and improve their confidence to organise and to identify and respond to the problem themselves. This is new to the context of Bangladesh and reveals a new start line for Mymensingh that is also different from Dhaka, as identified in chapter 4. Although this indicates an increasing complexity in actor interactions and their improved adaptive capacity and governance approaches, the opportunities for employing a new governance structure (hybrid and polycentric) identified through this research signify that it is helpful to identify enabling factors to recognise and guide such complexity and understand how to facilitate sustainable growth.

The research findings presented in this chapter highlight a shift in governance capacity that is significantly influencing power dynamics and decision-making processes for managing the urban water system in Mymensingh. A focus on the enablers for delivering adaptive attributes and capacity has highlighted the evolving management and governance structure and transition context in Mymensingh Pourashava. The analysis found an emergence of new institutional and actor engagements, which are building leadership and bridging capacity to improve linkages and integration of knowledge. These adaptive governance approaches need nurturing if they are to become mainstream practices.

However, these approaches are also strongly dependent on donor investment and guidance, while the involvement of state agencies remains insignificant. The absence of donor support will likely determine the impact of these activities in the future. This chapter has outlined the adaptive governance principles that are capable of guiding sustainable transformation. A lack of guidance on how to mainstream such practices would be barrier to sustainability in this emerging city. Based on the research data and observation presented in chapters 4 and 5, the next chapter discusses how these understandings, in particular adaptive governance thinking, may facilitate sustainability transformation in Bangladesh—a case of global South context.

Chapter 6

Adaptive governance for advancing sustainable urban water management in Bangladesh

6.1 Introduction

Scholars have identified that the urban water system is facing wicked challenges in dealing with complexity and uncertainty arising from vast environmental degradation, rapid urbanisation and climate change impacts (e.g. Larsen et al., 2016; Tortajada, 2008; Hurlbert and Gupta, 2015). Thus, this chapter explores whether the adaptive governance (AG) principles identified in chapters 4 and 5 can facilitate urban water system transformation to deliver sustainable outcomes in Bangladesh (Objective 3). The Bangladesh context sheds considerable light on a nascent form of environmental governance for sustainable urban transformation in the global South (GS), in particular for the urban water system.

This analysis of AG in Bangladesh represents an important addition to the scholarly record. Given that the urban water system continues to be challenged due to increasing degradation and demand, relevant policy and practice professionals will continue to seek innovative governance mechanisms (e.g. adaptive governance) to develop the capacity to deal with contemporary sustainability challenges and drive the transition. The spectrum of emerging hybridised governance structures, in particular, observed through the Mymensingh case, represents a step towards understanding this 'capacity' context in relation to delivering necessary adaptive attributes for a governance transition to delivering sustainable outcomes.

To recap, the Bangladesh context represents regime-driven urban water development that is highly controlled by societal factors, including reducing health risks and enhancing flood protection. This goal was initiated by the colonial administration from the inception of the urban water system and therefore the normative underpinning of Bangladesh's urban water governance (UWG) regime system largely reflects the European model of conventional water management strategies (i.e. technocratic command and control) until the research period (2017) (chapter 1). However, the contemporary influence of decentralisation of the management system and participatory approaches across different scales (national, regional and local), leading to a change in values regarding environmental protection largely driven by international schemes (e.g. IWRM/MDGs/SDGs), has redefined urban water management goals and provided a window of opportunity to rethink governance approaches (section 4.2 in chapter 4, p. 94). Following these shifts in the governance regime, subsequent changes have been observed at the institutional level to influence the existing norms and formal organisational culture in practising innovation, experiments and alternative options (e.g.

rainwater harvesting, sanitation value chains, water safety plans) (section 4.2 in chapter 4, p. 94). The question is whether these organisations and involved actors have also built the capacity to accept these innovations and alternative options to drive the changes needed for a governance transition.

Organisations and actors engaged in Dhaka's water management practices have been found to be working in silos and resisting innovations and alternative options and have a tendency to rely on the conventional urban water management strategies (section 4.3 in chapter 4, p.96). Yet this research also found that Dhaka's water management system is far more advanced than those of other Bangladeshi cities and that relevant organisations and actors have built some level of adaptive capacity to deliver basic services (section 4.3 in chapter 4, p. 96). In addition, chapter 4 (section 4.2, p. 94) identified that some on-ground innovation, alternative technologies and strategies have been applied in Dhaka. However, given the size of this city, the increasing complexity in renewal and development of its urban infrastructure, the scale of its population expansion and pace of economic development, the challenge in managing Dhaka's water management is massive.

It is therefore doubtful whether current management capacity is sufficient to prepare such a large-scale and highly complex urban water system transition to implement SUWM practices. This finding aligns with other studies that show Bangladesh's water governance system is facing increasing gaps between 'official policies' and 'actual implementation' (Gain and Schwab, 2012, p. 838); and that policies have failed to increase capacity for adaptation (Rouillard et al. 2014). In the context of Dhaka, this study confirms scholars' findings of fragmented service delivery 'tumbling behind the required standards' and lacking capacity to expand (Moinuddin, 2010, p. 59); a lack of organisational and management capacity to address issues of power and inequality in service delivery (Akber et al., 2007; Hossain, 2011; Hackembroch and Hossain, 2012).

On the other hand, Mymensingh's water governance regime was found to be in a transition phase towards a hybridised governance structure, where new institutions and engaged actors are starting to provide innovative governance services along with the traditional centralised structure (chapter 5, p. 121). Here, different layers of actors and agencies (national/central/city-scale/local scale) operate under an institutional hierarchy with some administrative decentralisation to transfer decision-making and financial autonomy to local actors by

embedding them in the Pourashva's management system with other relevant actors (see details in section 5.2.3 in chapter 5, p. 120). Transition scholars argue that this hybridised governance structure produces less uniform regimes in comparison to the GN, where old technology and a relevant management approach can co-exist with alternative solutions and deliver the same services, which do not always influence transition processes but offer better opportunities for innovation (Hansen et al., 2018; Wieczorek, 2018). Further, environmental governance scholars argue that a hybridised governance system can create a platform for institutional activities involving a diverse range of actors that can drive sustainable changes (Berkes and Ross, 2013; Lemos and Agrawal, 2006; Kooiman and Jenroft, 2099; van de Meene et al., 2011; Pahl-Wostl, 2009). AG scholars reviewing GS cases also emphasise the need to examine governance strategies that build institutional and actor capacity to support a sustainable transition (section 2.3 in chapter 2, p. 32).

Thus, the Mymensingh case allowed us to look at how this hybridised governance structure is creating platforms and delivering attributes that are essential to building the adaptive capacities of institutions and actors (individual/group/communities) to transform the existing system to deliver sustainable practices. The insights generated from the Mymensingh case also add to the literature of broader environmental governance and more specifically adaptive governance at the secondary city scale, which is an under-researched area (Tutusausa and Schwartz, 2018; Jaglin et al., 2011; Noronha and Vaz, 2014). Additionally, understanding institutional and actor capacity to develop a sustainable urban water governance system in a secondary-city context enriches urban governance literature on environmental leapfrogging, which argues that less technologically advanced and less complex urban water systems (e.g. those in medium and small cities) have leverage in urban transformation (Tutusausa and Schwartz, 2018; Jaglin et al., 2011; Noronha and Vaz, 2014). In this instance, leverage relates to the enablers and adaptive attributes capable of developing SUWM practices in Bangladesh.

This chapter discusses insights from across the two core data chapters (Chapters 4 & 5) related to Dhaka, but in particular, Mymensingh. This analysis seeks to deepen our understanding of the relevant capacities necessary to shape a sustainable urban transformation. Drawing on insights from applying the adaptive capacity and attribute (ACA) framework (section 2.5, Chapter 2), this chapter discusses some of the key insights that emerged to the context of 'capacity' that is present (and/or absent) to discuss whether these capacities can deliver necessary adaptive attributes to underpin an urban water governance transition in Bangladesh.

In particular, this chapter reflects on the detailed insights presented in the previous chapter generated by an examination of evolutionary governance change processes in Mymensingh, which revealed a suite of niche projects that included multi-level strategies, aimed at improving a Pourashava's governance capacity.

Furthermore, this chapter also engages with findings from Dhaka (see chapter 4), to highlight synergies and/or tensions critical in the delivery of adaptive attributes. Finally, this chapter reflects on the utility of the ACA as a guiding framework in conducting the research and generating further insights concerning AG in a GS context. The benefits and tensions arising from implementing the pluralist research approach adopted in this study are also discussed.

6.2 Adaptive governance attributes for emergence and capacity development

Modern Bangladesh has seen significant shifts in the water governance regime where socio-political and environmental factors such as greater economic development, improved environmental conditions and sustainable urban growth have played a crucial, influential role. Findings in this thesis show shifts in societal norms and organisational culture appear to be progressing further in smaller urban systems (here secondary cities) compared to big, long-established cities. Despite policies to adopt adaptive and sustainable approaches (e.g. MDGs/SDGs/IWRM), Dhaka remains a traditional centralised system of control whereby contemporary state-led interventions appear unable to lead to transformational change. Following the data analysis, it can be inferred that Dhaka's water management system is not on a sustainable trajectory. This view aligns with other scholars who argue the way Dhaka is urbanising, the governance and management of service provision of water, sanitation and waste disposal need to develop in line with adaptive measures related to policy framing, appropriate infrastructure development and improvements in social capital (see e.g. Rana, 2008; Swapan et al., 2017).

In contrast, the hybridised governance structure within the Mymensingh Pourashava is showing promise for delivering more sustainable outcomes. The decentralisation of the local government administration and adoption of inclusive and participatory water management strategies have created platforms for smaller urban systems to experience institutional reform and to engage with a new mode of governance practices (e.g. hybrid governance, polycentric

governance). Here, the regulatory environment was instrumental - the Zilla Parishad Act (2000) and the Pourshava Act (2009) - in enabling devolution of management rights and power-sharing for decision-making and mobilising resources. This seeded an opportunity to experience innovative interventions resulting in a spectrum of hybridised governance structures within the Mymensingh Pourashava. This was an outcome of implementing interventions that described in section 5.2.3 in chapter 5 (p. 120) that includes Urban infrastructural and governance improvement project (UGIIP) and Mymensingh strategic development planning (MSDP) project and further creating a platform for the multi-level interaction of diverse actor clusters (e.g. state and non-state actors).

Scholarship within environmental governance and transition studies argues a hybridised governance structure is important for delivering sustainable outcomes (e.g. van de Meene et al. 2011; Lamos and Agrawal, 2006; Pahl-Wostl, 2009; Koiman and Jentoft, 2009), therefore the formation of this hybridised governance structure in Mymensingh Pourashava appears to be a step towards a governance transition for sustainable development. Although, as noted in chapter 2 in developing an adaptive capacity and attribute (ACA) framework, sustainable governance transitions within GS contexts also depends on institutional and actor capacity to recognise and implement innovative governance strategies (Kuzdas et al., 2015; Sowman and Raemaekers, 2018; Bakkour et al., 2015). Therefore, questions remain as to whether the observed hybridised governance structure and relevant actor clusters in Mymensingh are increasing adaptive capacity and the capacity to support a system change. The following sections shed further light on these capacity issues and discuss how these attributes are providing scope for a new governance mode to emerge and can drive a sustainable transformation.

6.2.1   *Capacity for effective participation and collaboration*

The research data presented in chapter 5 highlights the diverse actor clusters and their interaction at multiple levels of implementation in Mymensingh, which provides insights into a new institutional structure emerging, which infers some characteristics of a polycentric system. Polycentric institutions favour devolution of power and shared management authority by increasing non-state actor capacity and engagement in specific policy issues (Newig and Koontz, 2014; Crona and Parker, 2012; Huitema et al., 2009). Numerous GS scholars advocate for a polycentric approach as a means to reform governance practices to become inclusive and

participatory (Celliers et al., 2013; Falk et al., 2009; Srinivasan et al., 2013). Scholars also argue that the polycentric approach favours good governance principles, such as water rights, state accountability and transparency in resource delivery (Falk et al., 2009, Hurlbert and Gupta, 2017).

Similarly, the ACA framework highlights polycentric institutions (at multiple levels of implementation) as a key enabler for sustainable changes (chapter 2). While looking at the contemporary urban water governance practices in Bangladesh, this thesis has revealed the spectrum of hybridised governance structures by showing some polycentric features in Mymensingh. This hybridised governance structure exhibits a shared management authority in which different actors (state and non-state) are involved in the Pourashava's management activities through participatory decision-making and for mobilising resources. This confirms a subsequent power devolution (national/regional actor to local actor and community) that is also significant for supporting legitimacy, transparency and conflict resolution (see e.g. Azhoni et al., 2016; Regmi et al., 2016; Satumanatpan et al., 2014). By producing an annual report card and displaying a citizens charter in the Pourashava premises is an example of increasing visibility of activities, which highlights improved levels of accountability and legitimacy. Such processes of strengthening accountability and legitimacy highlighted by the scholar are needed for successful implementation of local-scale adaptation strategies in GS context (Conway and Mustelin, 2014).

The way this shared management system is working in the hybridised governance spectrum in Mymensingh, the involved actor clusters are seen as more connected and interactive and forming a new network configuration that is multi-actor and multi-level (chapter 5, Figure 5.1, p. 115). As GS studies indicated implementing polycentric approach facing barriers such as coordination gaps, lack of strategies to improve the capacity of the relevant actors for effective participation (chapter 2). The activities of this multi-actor and multi-level networks observed through this thesis have identified are showing this potential to overcome some of these challenges. This participatory approach and formation of networks are regarded as an enabler within the ACA framework. Indeed, the research data presented in chapter 5 further reveals that this enabler is acting as a knowledge source and supporting the shared management system by offering valid information, developing consensus regarding policy implementation and further generating new information and data. For example, a member of the actor clusters mentioned his voluntary participation in a drainage project, which resulted in the adjusted

design specifications based on his experience of that particular locality (ward) (Section 5.3.1, Chapter 5, p. 125). Likewise, another member from the actor clusters (who is a community representative and identified as a social and environmental activist) felt confidence in explaining how he learnt about the unfolding plans for future urban water management for Mymensingh city through a series of group meetings facilitates by the Mayor and Pourashava management staff. This process of knowledge generation and transfer is changing communities' perception and shows awareness and sensitivity to the issues of environmental changes and liveability (Chapter 5, interviewee quote 5 and 7, p. 128). Thus, similar to other GS scholars, such participatory approaches are regarded as important for developing communities' organisational capacities and resilience (see e.g. Bahauddin et al., 2016; Panditharatne, 2016; Orchad et al., 2015).

While this research did reveal that emerging multi-level networks in Mymensingh are facilitating active participation and collaboration, though investigating network centrality and cohesion was beyond the research scope. Such actor clusters and/or collaborative teams can provide an arena where social capital is enhanced and concerns are reformulated to generate innovation and new modes of governance (see e.g. Folke et al., 2005; Sharma-Wallace et al., 2018; Huntjens et. al., 2012; Pahl-Wostl, 2009; Cinner et al., 2012). As identified in chapter 5, the production of manure from solid waste through the coordinated activities of NGOs, research institutions and farmers is an example of successful collaboration and innovation. This innovation example exemplifies: the facilitation of cross-scale learning, shared visioning and a move to increase communities' organisational capacity – all attributes that were identified as important for improving capacity for driving sustainable resource management in the GS context and outlined in the adaptive capacity and attribute (ACA) framework (Chapter 2).

However, in contrast to this shared management system, network formation and improving communities' capacities, the experiences of Dhaka were found to be more rigid and operating through isolated state organisations with less opportunity for community involvement in authorising and mobilising resources. Although the research data showed changing actors dynamics and complexities using the lens of hydro-social contract (HSC) presented in chapter 4, however, the contemporary policies and implementation strategies failed to address these actors' complexities, nor do they support reforming the implicit social contract identified by scholars as necessary for sustainable urban water transitions (see e.g. (Brown et al., 2009a; Lundqvist et al., 2001; Poustie et al., 2016). Furthermore, research data also captured different

modes of partnership or alliance co-existing to support urban water governance systems in Dhaka. Enablers, such as a partnership approach and/or networks, could not foster the capacities needed for effective participation and collaboration. In particular, interviewees recognised DWASA, the major water supply authority in Dhaka, as functioning unilaterally reflecting the hierarchical and market mechanism influences on water management activities that typically lead to bureaucracy and path dependency. Although the inclusiveness and participatory approaches have long been advocated through national policies (e.g. adoption of IWRM in national water policy in 1999 and formulation of participatory guidelines for water management in 2000), lack of periodic updates of policies and strategic planning, the relevant authorities operated in the conventional system, which is a barrier to implementing sustainable practices. The research data also presented similar observations concerning other water management authorities across Dhaka. The relevant organisations in Dhaka are far from realising the required capacity for addressing the diversity, density and complexity of agency/actor engagement and partnership arrangements.

Indeed, Poustie et al., (2016) indicated this 'capacity' issue in regards to understanding how to reform current HSC for driving sustainable urban water transition of a small island urban water system (section 2.3 in chapter 2, p. 32). The author utilised van de Meene and others (2010)'s regime capacity framework (originally published by Brown et al., 2006) and further explains capacity at four nested spheres: individual, intra-organisational, inter-organisational, and administrative and regulatory elements. The ACA framework used in this study aligns with these four spheres explains in the regime capacity framework, however, further broadened this 'capacity' issue to a more systematic approach that includes an understanding of the relevant structure and processes those are necessary for capacity development. ACA framework explains the capacity of the involved individuals and/or group in regards to their capacity for improving inter and intra organisational activities (collaboration/network/participation), and further reflecting policy and regulatory reframing.

Therefore, the capacity context captured through the ACA framework, this PhD study confirms that Dhaka lacks capacity in all four spheres, which is inhibiting effective participation and collaboration. On the other hand, the hybridised governance spectrum in Mymensingh seems to enable a platform for improving all spheres of capacity, in particular, the capacity to engage in a collaborative and network activities that connect different actors of organisations (intra/inter). The dominant disciplinary context of the majority of water professionals in Dhaka

(e.g. backgrounds in either engineering or hydrology) shaped the more technocratic and science-based urban water governance regimes in Bangladesh, which was disassociated from the socio-cultural aspect of water was missing. Although recent changes in regime approach (outlined in chapter 4, section 4.5, after 2006) enabled other professionals including economists and social scientists, to build a participatory and multi-disciplinary team to develop policies and undertake strategic planning, the implementation activities in Dhaka have not reflected these changes. However, the Mymensingh case showed that for the MSDP implementation, the Pourashava is already seeking expertise from different professionals to support their activities (section 5.4, p. 133). While it was beyond the scope of this thesis to determine the outcomes of the MSDP, it is reasonable to infer that management actors of the Pourashava have developed the capacity to recognise the important contribution diverse professionals can provide if they are to secure a sustainable urban water system.

In regards to intra- and inter-organisational capacity, chapter 4 identified gaps in the capacity to engage in networks, partnerships or in coordination across relevant organisations for the delivery of urban water services. For example, interviewees (chapter 4) identified coordination issues between DWASA and the two city corporations in stormwater management, ambiguity in defining shared responsibilities among the relevant agencies, and a lack of organisational interest in resolving coordination issues. Thirty-nine organisations are involved in water management activities, and this capacity gap for coordination spans different organisations creates a 'dynamic but messy' (Bird et al., 2018, p. 7) situation in Dhaka. Whereas the Mymensingh Pourashava's emerging hybridised governance structure, with a polycentric institutional setting and bridging organisations that offer diverse actor involvement (e.g. TLCC/WLCC) in a single platform are reducing coordination gaps at organisation and implementation levels (section 6.2.2 further illustrate on bridging organisations and leadership capacity). This coordination gap across relevant organisations and actors has identified by the scholars irrespective to GN and GS as a major obstacle for achieving sustainable management approach (Moinuddin, 2013, 2010; Mugabi et al., 2007; Brown et al., 2006; Farrelly et al., 2012, Marsalek et al.., 2001).

The administrative capacity and the regulatory sphere appear relatively promising for both Dhaka and Mymensingh, where a number of long-term plans adopted that include innovation and experimentation around infrastructural development, resolving water supply security, drainage and sewage system development and disaster proofing. Yet, although these

administrative and regulatory changes are occurring, major issues associated with water quality, inequality and access to water continue to be overlooked in key policies and strategic planning, despite their importance for delivering sustainable urban water practices in Bangladesh.

6.2.2 *Capacity to lead initiatives for sustainable outcomes*

As identified earlier, the actor clusters in Mymensingh Pourashava were found to be acting as bridging organisations, whereby actor clusters are forming new multi-actor and multi-level networks. The actors' clusters are found strengthening linkages across different implementation scales (city, ward and community level) and starting to involve actors those were not connected before. The series of group meetings and other activities by these actor clusters are an impetus to knowledge generation and transfer. The activities by the actor clusters are bringing state and non-state actors into a single platform so that they can connect and participate in management activities. These activities are further increasing community capacity and increasing access for mobilising resources. The way these actor clusters are involved and providing guidance to support state-led interventions, this further building trust in state actors and organisations (here Pourashava). The bridging organisation and relevant functions are noted in the ACA framework as enablers for delivering adaptive attributes that indicted by the GS studies as critical in supporting innovative solutions, alternative trajectory development and to manage environmental problems in an adaptive manner (Butler et al., 2014; Clark and Semmahsak, 2013; Azhoni et al., 2016; Folke et al., 2005; Newig and Koontz, 2014).

Beyond actor clusters, this research also revealed how the MDSP project bridges/connects local actors to a national context and national actors to a local context. The MSDP facilitated the development of a shared vision for building a disaster-resilient city (chapter 5). This project utilised the actor clusters and their capacity as individuals and/or groups in a new network configuration to develop a twenty-year city plan based on their experiences and increased understanding of sustainable agendas. MSDP developed and delivered this plan to guide Mymensingh city's growth along a sustainable trajectory, which is proposed by local communities and identifies critical and emerging environmental problems. This PhD research regards the project as an experiment in initiating bottom-up learning approaches to city planning. The MSDP plan also offered a platform for integrating science, policy and local knowledge to guide a city to a shared vision for a sustainable future.

This research indicates that the activities of the actor clusters (formed through UGIIP implementation) and MSDP guidance are a step towards sustainable governance transitioning in Mymensingh. However, these are largely project-dependent and guided by objectives and strategies designed by transnational actors/organisations. Although state actors are involved in the implementation, the leadership provided by these transnational actors (i.e. ADB, UNDP) also guides these local-scale initiatives to achieve a global outcome. If such actors/organisations were not involved, we might ask whether positive indications remain. This is very typical for the developing countries context, where some tensions and cynicism remain around the donor invested project, in the sense that these are often isolated and one-off project (Hanse et al., 2018; Hansen and Nygaard, 2013). There are also tensions around too much dependency on donor invested project further become an impediment to achieving or sustaining the expected outcomes (Hansen and Nygaard, 2013). For Bangladesh, the leadership provided by transnational actors has been very significant in leading and shaping urban water sector development. This is evident from the evolution of Bangladesh's urban water system (chapters 4 and 5). Indeed, there are plenty of examples in Bangladesh of unsuitable programs and the transfer of inappropriate technology and management tools (typically from the global north to global south contexts), which has led to developments are either regarded as unsustainable or failed due to transnational actors withdrawing their support. This remains an ongoing challenge in developing-country contexts (see e.g. Poustie et al. 2016; Easterly, 2009; Wieczorek, 2017). Whilst this challenging political and international relationships in this space of transnational actors and their connectivity to support transition requires further examination, yet through the ACA framework, the leadership role of transnational actors is found critical in designing and implanting projects those can guide to a sustainable future.

This study found that ADB funded UGIIP project adopted relatively a non-traditional implementation approach, where this project has a longer time frame. In Mymensingh, Phase-I started from 2003 and Phase-III was about to commence until this research period (2017), (further details in chapter 3, p. 81). The iteration process of this project implies that the platform it is creating are further supporting learning processes to occur (which further discussed in section 6.2.3). The actor clusters and hybridised governance structure is basically an outcome of this project implementation which mainstreamed into Pourashava's activities for supporting decision-making and implementation processes. What is unique about the activities by these actor clusters is that some of the community leaders are trying to continue these group meetings even there is no project support available. The motivation for continuing these activities by the

actor clusters, especially the town-level coordination committee (TLCC) is coming out from this democratic sense that developed in Bangladeshi people through a long struggle (British and Pakistan ruling, see chapter 4 and 5) of independence. This reflected in the statement from the interviewees' that TLCC is their mini parliament where they feel confident and empowered to raise their voice over their preferences to support Pourashava's activities.

Indeed, the research data shows that there is relatively slower progress in actor cluster activities in Mymensingh during the research data collection period (2016-2017), the mayor of Mymensingh was using his political and social influence (as a successful businessman) to encourage the activities of TLCC to continue. This individual's ability to lead initiatives has emphasises within a number of GS studies (Kuzdas et al., 2015; Hurlbert and Gupta, 2016) further indicating this local leaders' contributions and efforts might bring 'positive governance outcomes' (Kuzdas et al., 2015, p. 264; Ahammad et al., 2014). This importance of frontrunners/leaders as individuals or as a group is also acknowledged in GN literature (Farrelly and Brown, 2011; Boss and Brown, 2012). However, what is emerging from this research is that more often too much dependency on one individual can create one-man show rather than supporting participatory or inclusiveness into the decision-making and implementation approach. This might also raise conflict and further indicate opportunities for misuse of power. This power issue captured by this thesis further benefit in understanding the tensions in relation to dominant individual influence in decision-making processes. This use/abuse of power has been raising attention of scholars in regard to natural resource management (Wittmayer et al., 2014), environmental governance (Newig and Koontz, 2014) and improving urban transformative capacity (Avelino and Rotmans, 2011; Wolfram, 2015).

For Mymensingh, while a majority of interviewees expressed their gratitude and trust in the mayor's ability to lead sustainable initiatives, a few expressed criticism and frustration explaining this leadership failed to translate across political spectrum leaving other potential key individuals (those are having a different political view to the mayor) from the decision-making processes. At this point, the interviewees seek for developing a distributed nature of leadership where more grassroots leaders or frontrunners capacity can be nurtured to support and lead the contemporary initiatives for sustainable outcome. What this referring is a need for power redistribution and minimum conflicting situation for mobilising and accessing resources at a local scale.

While the research data revealed emerging leadership capacities in the form of individuals, groups or organisations (e.g. Pourashava) at the local level are emerging and might drive sustainable growth. There are limited scope for the regional and national level actors to lead policy implementation and to connect with local scale implementation. While this capacity gap at regional and national level actors is critical for cross-scale interactions and further developing vertical linkages. The transition and adaptive governance scholar continues to emphasise the need for vertical linkages and cross-scale interactions for driving sustainable change (Bai et al., 2009; Naster 2014; Azhoni et al., 2016; Falk et al., 2009; Kuzdas et al., 2016). The findings from the research explain that these regional and national level actors are rigid, bureaucratic and have a critical view on innovation and experiments. Chapter 5 provided some examples in this context in particular when explaining MSDP experiment in Mymensingh to increase bottom-up learning; where some of the staff have expressed their frustration regarding other state organisations and their lack of capacity in understanding alternative options and or experimentation. This is also found in the case of Dhaka, where state organisations are not capable of designing, implementing and supporting interventions that can lead to developing a sustainable trajectory (chapter 4). This further infers that these disconnected regional and national level actors might become a barrier for further driving sustainable transition in Bangladesh despite capacity increased at the local scale.

6.2.3 *Capacity for experimentation and social learning*

In the context of GS, scholar expressed their concern by stating that although GS cities have strong imperatives and uniqueness, however, due to capacity gap at different scales of implementation, innovate and experiment for sustainability is not occurring (Nagendra et al., 2018). The findings presented through the ACA framework in this thesis now can infer that the context is changing. The hybridised governance structure in Mymensingh offering an interactive platform for a range of actors to provide governance services which GN literature suggest can improve capacity to embrace experimentation and learning (Farrelly and Brown, 2011; Bos et al., 2013). While the UGIIP project implementation signifies for the emergence of the hybridised governance structure and assisting in improving institutional and actors capacity in this space, the MSDP project is conceived as an experimental, multi-actor platform and further offering platform for bottom-up city planning. The MSDP project used this hybridised governance structure to involve the relevant communities in identifying their urban development-related problems and possible solutions and then outlined a twenty-year plan by

utilising bottom-up thinking. This approach stands in contrast to the generic understanding of transition scholars reviewing the GS context and explains that innovations in this space are often confined to a single experiment or aimed at a set of specific goals set by donor agencies rather than using innovation as a platform for further experimentation (Hansen et al., 2018).

The AG guiding framework identifies experimentation as an important adaptive attribute and indicates that it can offer scope for different social learning processes to occur. Table 2 in chapter 2, p. 47) captured learning as a critical adaptive element and further characterise it in terms of different orders, single, double and triple-loop learning. Global North (GN) literature has defined this learning orders and further explains how this can support adaptive governance implementation (Armitage, 2008; Pahl-Wostl, 2007; Reed et al., 2010) and continues to diagnose this learning to understand how this support a governance transition (Bos et al., 2013; Farrelly and Brown, 2011, Pahl-Wostl, 2007, 2010). Scholars emphasise the different learning loops as important for co-management approaches (Armitage et al., 2008, p. 88), and in particular double and triple-loop learning is seen as essential for governance transition (Pahl-Wostl 2009, 2015). However, GS studies (chapter 2) show only a limited and implied understanding of the capacity for social learning to support a governance transition (Lubella and Edelenbos, 2013; Rist et al., 2007; Shackleton et al., 2009). Thus, social learning processes appear in the ACA framework in chapter 2 as an implicit element and are closely linked with other enablers. However, based on the findings of this study in relation to this social learning component and their influences over capacity and change, it appears exploring social learning processes might be useful to understand the necessary governance transition and thus further realised that the ACA framework needs a revision to include this social learning as an important enabler for AG implementation.

In this light of social learning processes, the UGIIP can be conceived as an example of a continuous learning effort starting from 2003 to increase governance capacity at a local scale, including building infrastructure for developing the urban water system. MSDP, on the other hand, refers to an experiment that have this bottom-up thinking feeding into national policy processes towards sustainable city development. UGIIP is being implemented in phases (as of the research period in 2017, the evaluation of Phase II was being completed to start Phase III). A new phase implementation depends on the evaluation and feedback from the earlier phase to improve the outcome. Thus, we can infer that this project is contributing to single-loop (incremental improvement of implementation without questioning the underlying assumptions)

and double-loop learning (a revisiting of assumptions, e.g. the cause-effect relationship) (see e.g. Armitage et al., 2008, p. 88; Pahl-Wostl, 2009, p. 359; Pahl-Wostl et al., 2010). The UGIIP project revealed some scope for triple-loop learning processes, including, for example, influencing governance norms, values and protocols, all well-acknowledged features.

This thesis finds that the MSDP project is developing a bottom-up approach to planning, with a 'learning-by-doing' strategy. This is new in planning and city development approaches in Bangladesh. This experiment is also driving a shift in norms and in people's conception of resilience and sustainable thinking (section 5.2.3 in chapter 5, p. 120). The MSDP project activities were underway during the data collection period (2016–17) for this thesis, which inhibits the researcher's ability to determine how successful the project was. Yet, at the time of this research, the Pourashava had started to use the draft plan as a guide for developing the city in a sustainable manner. However, this research suggesting that this might be a great scope for exploring further to understand double and triple-loop learning scopes in Bangladesh to drive a sustainable outcome. That meaning MSDP has found in this study as a missed opportunity that could be better strengthened moving forward if such governance approaches were considered through the lens of experimentation (e.g. Bos and Brown, 2012).

Dhaka, on the other hand, was found to rely on conventional governance systems, largely by a project-to-project basis and/or isolated implementation by the relevant organisations struggling with coordination, which largely supports single-loop learning processes. As outlined earlier, the empirical data did not reveal any significant improvement around adaptive and sustainable initiatives in Dhaka, suggesting water governance has limited scope for double and triple-loop learning.

Overall, the emergence of social learning processes in a particular context, capacity or actor (an individual, a group in wider social units or communities of practice) is required for a change in governance approach if sustainable growth is to occur (Reed et al., 2013). This is closely related to the discussion presented in sections 6.2.1 and 6.2.2. It appears that perception of change or the power to make a difference/change has been observed in an individual as part of the actor-clusters, networks and engaged communities. The insights generated from the Mymensingh case indicate that the spectrum of hybridised governance is enabling a platform for social learning processes that can improve capacity to practice joint initiatives/collaboration by involving diverse stakeholder participation in achieving the goals of governance.

6.3 Adaptive governance for a governance transition in the global South

The previous section highlights capacities present (and/or absent) for the emergence and implementation of adaptive governance in urban Bangladesh. The ACA framework featuring adaptive attributes and capacity has been useful to understand the contemporary capacity and governance contexts between two Bangladeshi cities. This thesis highlights the spectrum of the hybridised and polycentric governance structure, which are creating capacity platforms for effective participation and collaboration, for developing bridging functions and leadership capacity and more often to support experimentation and learning to occur. These findings extend environmental and urban scholars' views on hybridised structures for governance transformation by revealing how new multi-scale strategies and institutional structures are encouraging and supporting activities those are useful for increasing relevant capacity at a local scale. This findings also address adaptation scholars concern regarding the newly employed institutional settings in global North and South, yet to provide evidence regarding their effectiveness in adaptation strategies (Conway and Mustelin, 2014; Huntjens et al., 2012).

This research finds that leadership from individuals, groups and communities is critical for a transition; therefore, need to nurture this capacity through incentives and relevant training. Local actors are active and supportive of sustainable initiatives; however, regional and central/national state actors are less active or a missing link in the governance regime, which delays and sometimes becomes a barrier to a sustainable outcome. This thesis suggests a mix of top-down and bottom-up initiatives is important for improving capacity and to rectify missing links. Bridging organisations and their functions provide opportunities for collaboration, new network formation and coordination.

Informal dynamics or shadow systems within the governance structure have been found to offer critical space for social interaction and to drive innovation and experimentation. In Bangladesh's urban water system, such informal dynamics provide governance services where state-led interventions or relevant government organisation have failed to deliver essential services (chapter 4). For example, NGOs and private organisations are starting to build septic tank-based sanitation systems where government organisations focus on water supply rather than sanitation services. Transition and AG scholarship recognises the importance of informal institutions; however, it also notes that these institutions need to be integrated into or embedded

with the formal institutions (Folke et al., 2005; Loorback, 2010; Olsson et al., 2006). We have seen in the broader Bangladesh context (particularly in Dhaka) that more often than not these informal institutions have failed to integrate with or to complement the formal system (chapter 4). Whereas in Mymensingh, as we have seen, informal groups can complement government efforts in resource management, such as the active participation of actor clusters in the Pourashava's implementation processes and collective efforts led by private organisations and NGOs to produce organic manure from recycling waste.

This PhD research has developed a nuanced understanding of key attributes and enablers of adaptive governance that resonates with emerging thinking known as 'transformative governance'. This is viewed by scholars as a step beyond adaptive governance and shares elements supporting governance transformation (Pelling, 2011; Chaffin et al., 2016; Pahl-Wostl, 2017). In the context of urban transformative capacity, Wolfram (2015) has also pointed out ten common interdependent components to global North and South countries. The findings from the cases, looking at the spectrum of hybridised governance structure and the relevant capacity context in Mymensingh, are similar to those of the above-mentioned scholars. The understanding developed through this research can provide an empirical illustration that might enrich adaptive governance as a stepping stone to 'transformative governance'.

The findings from this research further note that in the GS context, to continue such hybridised forms of governance to support a transition, relevant policy, strategic investment and guidance are necessary. Governance transition also demands that state and transnational actors lead initiatives towards a shared goal of sustainability. This can be achieved through redefining the social contract for water, which appears to be shifting towards a participatory approach with an increasing focus on environmental protection, while the state is still considered the major responsible authority. The revised social contract should reflect increasing non-state actor involvement in critical decision-making, such as resource distribution and access, and inequality. This would provide opportunities for redistribution of power, integration of knowledge (i.e. scientific, policy and local). In addition to environmental concern, the revised social contract should consider critical phenomena such as communities' concern for liveability and environmental wellbeing. For achieving MGDs target, Bangladesh unlike other countries from the GS implemented projects those are isolated and further might have compromised the environmental issues (developing toilets without much thinking the faecal sludge management) which now becoming major impediments in achieving SDGs. Thus, the insights generated

through this research in light with urban water system to build capacity for delivering adaptive attributes and to further thinking about reforming HSC might bring the changes that might be useful for achieving sustainable future in Bangladesh.

Overall, this research reveals a very broad sweeping view of the range of adaptive attributes and capacity context may be necessary for promoting adaptive governance. For moving forward to a sustainable future, there are still many opportunities are emerging that might needed further details empirical research to foster a capacity for driving sustainable transition in the GS context. This thesis also sheds light on small-scale urban water systems and their leverage for implementing adaptive and transformative capacity and governance. This understanding adds to the concept of environmental leapfrogging (Perkins, 2003; Poustie et al., 2016; Watson and Sauter, 2011) and provides an empirical illustration of how adaptive governance principles are guiding the processes so that this leapfrogging might be achieved.

6.4 The value of the ACA framework and pluralist research approach

The ACA framework used in this thesis was developed by reviewing empirical GS cases featuring adaptive governance in relation to capacity and key adaptive attributes (Chapter 2). This framework was found to be valuable in identifying the key AG elements and interaction processes 'within level' and to build our understanding of their dynamics and interrelations in governance change processes. This AG framing also generates insight into a holistic view to support sustainability transformations in the GS. This insight contributes to the transition and water governance literature that provides broader conceptions of governance change processes and associated adaptive capacity for the resilience of the STS and SES (water, energy) (Birkmann et al., 2010; Folke et al., 2005; Gunderson and Light, 2006; Pahl-Wostl, 2009). It also enriches AG scholarship by providing an empirical understanding that can address the issue of AG applicability in the GS context (Hurlbert and Gupta, 2016; Chaffin et al., 2014; Clark and Semmahasak, 2013).

The ACA framework uses the key issues of 'actor and institutional capacities' and points to a series of enablers of change to guide investigation of different structures and processes that drive or inhibit change at different scales. Scholars identify such investigation as necessary to encourage sustainability transformations and in diagnosing the degree to which they are present

in a system, to allow strategic interventions (Chaffin et al., 2014; Karpouzoglou et al., 2016; Pahl-Wostl et al., 2012). Using AG framing, this thesis presents a system-view approach to identify necessary elements of adaptive governance and their contributions in system transition in a GS context. This pursuit of system approach advocated by the urban scholar for sustainable urban transformation (Conway and Mustelin, 2014). The understanding developed through this thesis also reinforces the applicability and utility of broader AG principles that have emerged from the GN context and builds an understanding of the benefits and tensions in applying AG to the context of the GS.

The findings from this PhD study inform other key elements, such as social learning and collaboration, which are found to be critical in the Bangladesh context but are missing from the original version of the AG framework. Therefore, a revised schema is presented here that informs governance structure and processes that can enable AG implementation in a GS context. Leadership becomes more distinctive in this version of the AG framework, as it was found to be crucial to leading sustainable initiatives aimed at governance transition. Future research could further unpack these elements through in-depth exploration.
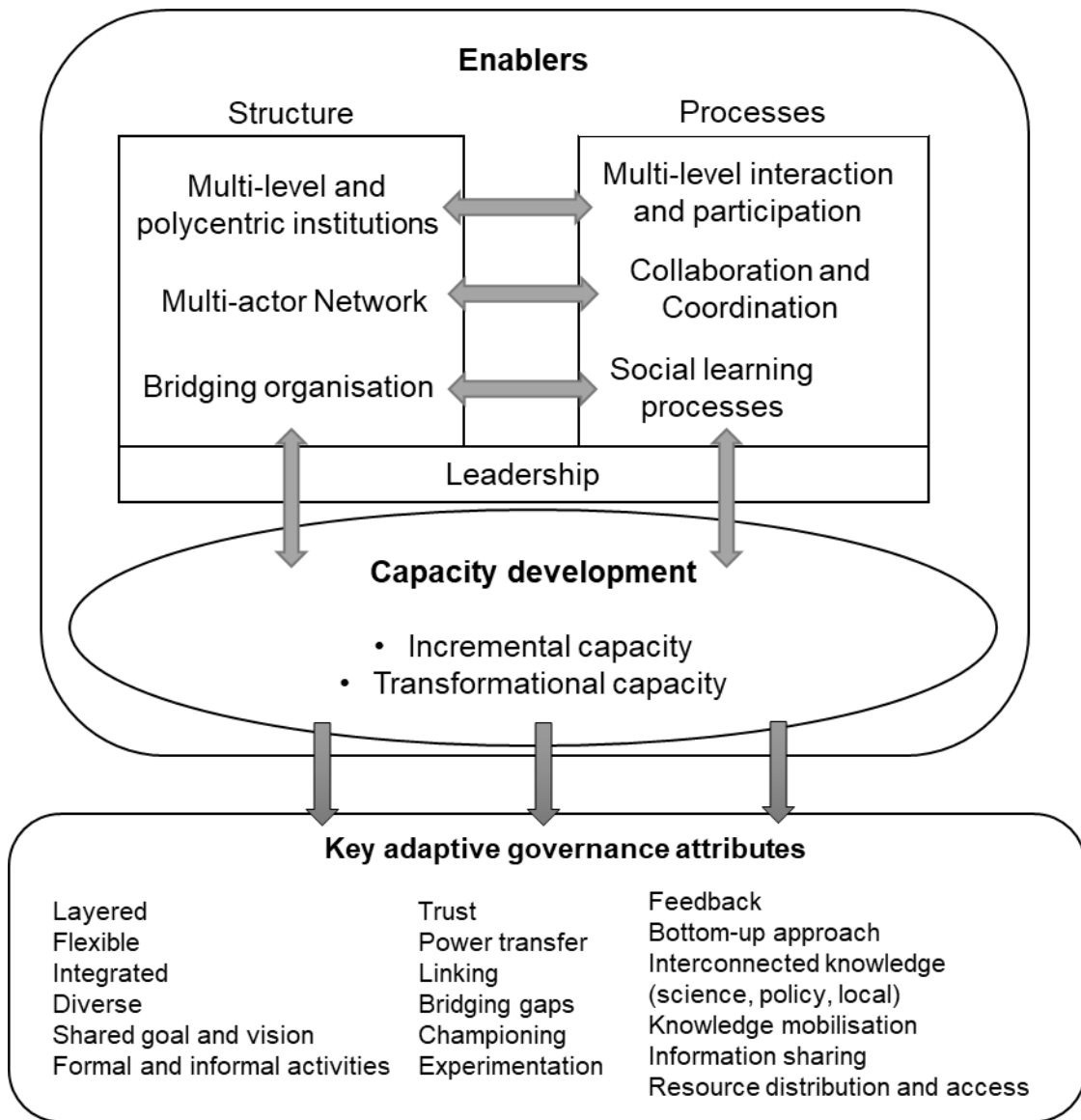
Figure 6.1 Revised schema of the guiding framework featuring adaptive governance principles (Adapted from, chapter 2, Yasmin et al. 2019)

This research is based on the understanding of the concepts of urban water management and adaptive governance attributes that arise from the in-depth review of GS country cases. The focus on specific AG attributes led to more attention being given to a set of attributes and the enabling context. These were identified through the critical review (i.e. polycentric governance, participation, leadership and bridging capacity), with less attention to others such as experimentation and learning processes, which are noted by scholars and are also crucial for urban sustainability, and also confirmed in this thesis.

The adoption of a pluralist research approach shows the advantage of different theoretical angles in analysing AG attributes that can support cities' governance transition towards a sustainable pathway. The insights derived from this research generally agree with the notion of 'integration of diverse disciplinary knowledge' supported by the interdisciplinary group of young scholars looking specifically at the GS context for SUWM application, including this research (Barron et al., 2017). This also aligns with environmental governance scholars' suggestion of developing and refining multiple methods that could support various change processes for sustainability transformation (Chaffin et al., 2014; Karpouzoglou et al., 2016). Indeed, the insights gained (i.e. the gaps, lessons learned) and adaptive capacity achieved in each case by applying different theories (e.g. MLP and AG) enrich the literature by revealing how adaptive governance thinking might guide sustainable pathways in Bangladesh. These insights could inform targeted audiences (i.e. policymakers, urban practitioners, international and national development agencies, civil society and other private actors) involved in governance transition to support sustainable development in Bangladesh and similar contexts.

In light of this pluralist approach, this research used MLP to identify the historical context of urban water development in three different socio-political situations and to identify the institutional development at distinctive levels (niche, regime and landscape). Thus, AG framing assisted in identifying the nature of these emerging institutions and what this means for implementation. It also served to assess the adaptive capacity built over time. MLP was used to analyse the interplay between relevant actors and institutions at different levels, while AG framing enabled examination of smaller-scale institutional reforms.

This research also pointed to opportunities for actor engagement and raising community voices in decision-making. It showed that significant challenges in institutional and actor capacity continue to impede adaptive capacity and thus the application of adaptive governance in Bangladesh. The framework also showed that capacity development is linked to the various enablers (i.e. multi-level and polycentric institutions, participatory approaches and networking and bridging organisations and leadership), to delivering adaptive attributes and underpins sustainable transformation processes. This was evident in the empirical findings of this research and reinforced the importance of this framing for such assessment. Undertaking more case studies, especially from other developing countries using an AG framing, would refine this framework and potentially increase its value.

The two frameworks (MLP and AG) provided different angles to explore the capacity context during the research, adding empirical depth to adaptive governance and sustainable transition literature that offers a broader understanding of complex interactions and coordination among institutions and other actors at different implementation levels (Rouillard et al., 2014; Bai et al., 2009; Wieczorek, 2017). The utilisation of these two frameworks also enriches understanding of their applicability in the GS context. For example, the way MLP was applied in this research helped to overcome the potential of blurry distinctions between the three analytical levels. Nor was it confined by the generic understanding of MLP in the GS context of the regime as a national phenomenon, landscape as a more global phenomenon and niche as a regional or local phenomenon (Geels, 2011; Hansen and Nygaard, 2014).

6.5 Summary

The insights generated through this thesis highlighted adaptive governance principles in capacity development to support a governance transformation for advancing sustainable practices in Bangladesh. The capacity context also shed light on the enablers and critical adaptive attributes identified through the ACA framework and indicates the interdependencies of these enablers and attributes. This study observed different starting line and capacity contexts at different city scales that are guiding the development of a sustainable trajectory in Bangladesh's urban water system. The large-scale urban water system of Dhaka was found to be facing complex governance challenges, entrapped as it is in technological and bureaucratic path dependencies.

This study shows that Dhaka's water governance regime is lacking in all the aspects of capacity needed for effective participation, collaboration, leading sustainable initiatives, supporting experimentation and learning. The social contract for water service delivery is still dominated by state authorisation, with limited scope for wider participation. It is evident that Dhaka (and other cities in Bangladesh following the Dhaka model) is not yet on a sustainable trajectory. The way Dhaka is progressing, it might need more time to address the underlying governance challenges, to redefine the social contract, and to increase the capacities needed to deliver adaptive attributes such as those presented in the revised guiding framework for transforming the urban water system into a sustainable one.

In examining the case of Mymensingh, in particular, its hybridised governance structure, the thesis showed that this small-scale urban system is offering better opportunities for initiating a governance transition than the larger urban water system. All aspects of capacity in Mymensingh city were found to be promising. The research also identified the potential for the delivery of critical adaptive attributes needed to develop adaptive and transformative capacity.

One can infer that Mymensingh city will progress relatively faster than big cities in Bangladesh on a sustainable pathway. Yet critical elements are required to guide if the hybridised governance system is to continue. These include: continued strategic and financial investment from the government and transition to develop the small-scale urban system; redefining the social contract to redistribute power; improving the leadership capacity of individuals and networks; space for bridging organisations to perform and to mediate; facilitating informal dynamics or shadow systems; and to support further experimentation and innovation to foster social learning processes.

Chapter 7

Conclusion

Rapid urbanisation can drive a sustainable change in cities despite its consequences often including increased complexity in human, social and environmental conditions. Delivering sustainable cities (SDG11) will require attention to a number of different urban functions, including urban water systems. To date, in rapidly urbanising global South cities, urban water systems are often limited in their quality, supply and reach, despite growing demand for clean, secure water supplies, sanitation systems and stormwater management. This crisis related to the delivery of water-related services is also recognised by scholars and development agencies as a crisis of governance. They indicate that the current approach to urban water management is incapable of addressing such a water governance crisis.

Sustainable urban water management (SUWM) is proposed as a way forward. However, implementing SUWM requires improving capacities and governance systems for managing the urban water system. Adaptive governance (AG) scholarship proposes approaches that can improve adaptive capacity; yet applying these approaches largely remains at a policy and planning level, especially in the global North context. The global South has begun to acknowledge these concepts (e.g. SUWM, AG), yet examples in real-world contexts remain rare. This thesis aimed to examine *the role of adaptive governance in supporting transitions towards sustainable urban water management (SUWM) in the global South*.

A pluralist research approach was adopted to achieve this aim. This approach distilled key concepts and theories from AG and sustainable transitions (ST) scholarship. Collectively, these scholarships suggest attributes for creating an enabling context required to increase the adaptive capacities of contemporary urban water systems. As the foundations of these concepts and theories are largely from GN experiences, applying these concepts to the diverse social and structural context of the GS is not a straightforward task. Contemporary research in the GS has begun to use adaptive governance principles and approaches to guide empirical investigation; however, it has not yet generated enough evidence on the relevant attributes and the enabling platform that might guide a governance transition in the GS context.

As empirical investigation for this thesis, an embedded case study approach was adopted to examine Bangladesh's urban water governance context. Adopting qualitative research techniques including semi-structured interviews, oral histories, and media content, alongside secondary data analysis, this study examined different water governance contexts in Bangladesh to improve our understanding of the adaptive capacities required to deliver more

sustainable urban water systems. Prior to data collection, a guiding framework labelled 'ACA framework' (chapter 2) was developed, and proved useful for structuring data collection and analysis, and for identifying different capacity contexts through the lens of enablers and adaptive attributes required to drive a change towards sustainability.

Indeed, in developing an adaptive capacity and attribute (ACA) framework by featuring adaptive governance principles, chapter 2 revealed the enabling contexts that are essential for underpinning a sustainable governance transition, focusing on urban water systems in the GS (Objective 1). This chapter also generated insights on how the adoption of AG approaches in the GS faces challenges such as institutional inertia and actor/organisational capacity issues. While many of these challenges also resonate in GN contexts, GS contexts have a different manifestation, understanding and 'starting line', given many of the agencies facilitating and brokering these opportunities often bring in 'wisdom' from the GN rather than cultivating appropriate strategies for the GS. An examination of empirical cases of adaptive governance in the GS and the development of the ACA framework (chapter 2) extended contemporary understandings of AG approaches required for enabling change to deliver sustainable practices in GS countries (Objective 1). This work also contributed to scholarly conceptualisations of how to implement adaptive governance by developing the ACA framework to assist with identifying key capacity strengths and deficits in developing country contexts (Objective 1). The multi-level perspective (MLP) from ST scholarship was also utilised to support this analysis.

The insights generated through the empirical investigations undertaken by this study contributed to the literature by articulating the first comprehensive multi-scaled assessment of the historic and contemporary development pathways of Bangladesh's urban water sector. They also reveal significant shifts in water governance practices (chapter 4). This thesis found differences in starting lines and capacity between Bangladeshi cities. The analysis also demonstrated that Bangladesh has a long history of urban water resource management (begun almost 250 years ago) and contemporary developments demonstrate that significant changes have achieved in governance approaches by engagement with key international approaches and concepts to develop integrated water resource management (chapter 4).

While these changes have strengthened the national policies and strategic targets, they have not been implemented at all levels. Utilising the ACA framework, this multi-scale assessment reveals that large-scale urban systems such as Dhaka still face difficulties and need more time to improve capacity despite receiving the most attention from the inception of the urban water system in Bangladesh. The management and governance context of Dhaka's water system is multifaceted and existing capacity as assessed in this study is not sufficient to drive a governance transition for sustainable growth (chapter 4).

Based on this multi-scale assessment and AG framework, this thesis finds that other large-scale urban systems in Bangladesh, such as the statistical metropolitan areas (SMAs) (e.g. Chittagong, Khulna, Rajshahi) that are following Dhaka's water management strategies, are encountering similar challenges. Thus, one can infer that these cities also need time to develop the capacity needed to drive sustainable transition (chapter 4). By contrast, utilising the AG guiding framework, this thesis found a promising context exists in a small-scale urban system, Mymensingh, a secondary city in Bangladesh. This city was found to have greater advantages (e.g. citizen relationships and less conflict between state and non-state actors), and less complexity than Dhaka and the SMAs (chapter 5). While the literature acknowledges these small cities' advantages relating to opportunities to support sustainable growth, there have been very few attempts to unpack their potential.

This thesis, for the first time concerning Bangladesh, examined a small-scale urban water context and, by utilising the guiding framework, identified the enabling context that might support sustainable growth at a faster pace than the large-scale urban water systems in Bangladesh. This finding enriches the arguments on urban bias, where small cities had long been ignored by scholars, with big and megacities receiving more attention in academic literature. The thesis contributes to the adaptive governance and sustainable transitions literature by adding an empirical illustration of these concepts in a GS context. It also highlights the potential of developing cities in environmental leapfrogging (chapter 6) by uncovering the emergence of a hybridised governance structure in Mymensingh city that is capable of delivering the adaptive attributes and enabling context that might drive a sustainable transition.

Utilising the ACA framework, chapter 5 presents an analysis of the Mymensingh case, with an emphasis on the hybridised governance structure, which environmental governance and transition scholars identify as critical for deploying sustainable resource governance approaches (chapter 5). For Mymensingh, this thesis reveals that the hybridised governance structure offers a platform for participatory approaches, collaboration and forming new networks. This hybrid structure also provides scope for bridging activities and developing leadership capacity at the local scale. While the activities in a hybridised governance structure are largely an outcome of niche projects that are designed and implemented by transnational actors, their role is critical for Bangladesh (chapter 5).

The major themes arising from this thesis include the critical role of adaptive governance, which assisted in uncovering differences in capacity, in particular in the institutional and actor domains, despite relevant policies and strategic developing planning being in place (chapter 6, Objective 3). The pluralist research approach that combined the lens of adaptive governance and sustainable transitions is a powerful tool for understanding sustainable urban transformation pathways in the GS context. The MLP framework was useful in developing the chronology, using the concept of landscape, regime and niche levels (chapter 2, section 2.2). The AG guiding framework served to assess the adaptive capacity built over time, to highlight governance capacity and to reveal the enabling context for an urban society to improve its capacity to deal with social and environmental crises and change.

Based on the findings of this thesis, a revised guiding framework featuring adaptive attributes and capacity context presented in chapter 6 strengthens the comprehensive system view to support adaptive governance thinking in the GS context. Such a comprehensive system view can assist in driving a sustainable transition. The empirical illustrations and relevant findings from this PhD thesis show that AG approaches built upon GN constructions hold for the GS even if they need modification in particular contexts. This AG thinking has the potential to guide developing cities, in particular the emerging secondary cities, towards sustainability.

The understanding developed through this study sheds lights on the role of AG in the context of system scales and capacity (i.e. institutional, organisation and individual actor) that influence the pathways to sustainable development. It also reveals that capacity development is linked to the various enablers (i.e. multi-level and polycentric institutions, participatory approaches and networking and bridging organisations and leadership) and to offering opportunities to deliver

adaptive attributes and underpin sustainable transformation processes. This was evident in the empirical findings of this research and reinforced the importance of this framing for such assessment. Exploring more case studies, especially from other developing countries using this framing featuring the AG principle, would refine this framework and increase its potential value. These findings are critical to provoking a response from the relevant policymakers and practitioners in support of sustainable pathways in Bangladesh and other similar urban contexts.

References

ADB (2007). Asian Development Bank annual report, 2007. Department of External Relations. Philippines. Retrieved from https://www.adb.org/sites/default/files/institutional-document/31324/annual-report-2007-vol01.pdf.

ADB (2012). Asian Development Bank. The Urban Governance and Infrastructure Improvement Project in Bangladesh. Department of External Relations. Philippines. Publication No. ARM124937. Retrieved from https://www.adb.org/sites/default/files/publication/29976/urban-governance-infrastructure-project-bangladesh.pdf

ADB (2015). Asian Development Bank. Strengthening municipal Governance through Performance-based Budget allocation in Bangladesh Publication Stock No. ARM157795-2. Retrieved from https://www.adb.org/sites/default/files/publication/177452/strengthening-municipal-governance-bangladesh.pdf

Adger, W. N. (2006). Vulnerability. Global Environmental Change, 16(3), 268–281.

Agyenim, J. B., & Gupta, J. (2012). IWRM and developing countries: Implementation challenges in Ghana. Physics and Chemistry of the Earth, Parts A/B/C, 47, 46-57.

Ahammad, R., Hossain, M. K., & Husnain, P. (2014). Governance of forest conservation and cobenefits for Bangladesh under changing climate. Journal of Forestry Research, 25(1), 29–36.

Akbar, D., van Horen, B., Minnery, J., & Smith, P. (2007). Assessing the performance of urban water supply systems in providing potable water for the urban poor: the case of Dhaka, Bangladesh. International Development Planning Review (IDRP), 29(3), 299–318.

Allen, A., Dávila, J. D., & Hofmann, P. (2006). Governance of water and sanitation services for the peri-urban poor. London: University College London. The Development Planning Unit. Retrieved from https://discovery.ucl.ac.uk/id/eprint/52345/1/Allen_Davila_Hofmann_2006_WSS_PUI_book.pdf

Ansell, C., & Gash, A. (2008). Collaborative governance in theory and practice. Journal of Public Administration Research and Theory, 18(4), 543–571.

Araral, E., & Wang, Y. (2013). Water governance 2.0: a review and second generation research agenda. Water Resources Management, 27(11), 3945-3957.

Araral, E., & Yu, D. J. (2013). Comparative water law, policies, and administration in Asia: Evidence from 17 countries. Water Resources Research, 49(9), 5307-5316.

Araral, E. (2010). Reform of water institutions: review of evidences and international experiences. Water Policy, 12(S1), 8-22.

Araral, E., & Yu, D. (2010). Asia water governance index. Lee Kuan Yew School of Public Policy. Retrieved from https://lkyspp.nus.edu.sg/docs/default-source/iwp/awgi-brochure-iwp-lkyspp9-101036fe7a46bc6210a3aaff0100138661.pdf

Araral, E., (2009). The failure of water utilities privatization: Synthesis of evidence, analysis and implications. Policy and Society, 27(3), pp.221–228.

Armitage, D. R., Plummer, R., Berkes, F., Arthur, R. I., Charles, A. T., Davidson-Hunt, I. J., McConney, P. (2009). Adaptive co-management for social–Ecological complexity. Frontiers in Ecology and the Environment, 7(2), 95–102.

Armitage, N. (2011, January). The challenges of sustainable urban drainage in developing countries. In Proceeding SWITCH Paris Conference, Paris (pp. 24-26). Retrieved from

http://switchurbanwater.lboro.ac.uk/outputs/pdfs/W2-2_GEN_PAP_Challenges_of_sustainable_urban_drainage_in_developing_countries.pdf

Armitage, D., Marschke, M., & Plummer, R. (2008). Adaptive co-management and the paradox of learning. Global environmental change, 18(1), 86-98.

Ashley, R. M., Blanksby, J., Chapman, J., & Zhou, J. (2007). Towards integrated approaches to reduce flood risk in urban areas. *Advances in urban flood management*, 415-432.

Ashley, R. M., Balmforth, D. J., Saul, A. J., & Blanskby, J. D. (2005). Flooding in the future–predicting climate change, risks and responses in urban areas. Water Science and Technology, 52(5), 265-273.

Atkinson, R., & Flint, J. (2001). Accessing hidden and hard-to-reach populations: Snowball research strategies. Social Research Update, 33(1), 1–4.
Avelino, F., & Rotmans, J. (2011). A dynamic conceptualization of power for sustainability research. Journal of Cleaner Production, 19(8), 796-804.

Azhoni, A., Holman, I., & Jude, S. (2017). Contextual and interdependent causes of climate change adaptation barriers: Insights from water management institutions in Himachal Pradesh, India. Science of the Total Environment, 576, 817-828.

Bahauddin, K. M., Rahman, N., & Hasnine, M. T. (2016). Environmental reviews and case studies: Public perception, knowledge, and participation in climate change adaptation governance in the Coastal Region of Bangladesh using the Social Ecological Inventory (SEI) Tool. Environmental Practice, 18(1), 32–43.

Bai, X., Wieczorek, A.J., Kaneko, S., Lisson, S., Contreras, A., 2009. Enabling sustainability transitions in Asia: the importance of vertical and horizontal linkages. Technol. Forecast. Soc. Change 76, 255–266.

Bakkour, D., Enjolras, G., Thouret, J. C., Kast, R., Mei, E. T. W., & Prihatminingtyas, B. (2015). The adaptive governance of natural disaster systems: Insights from the 2010 mount Merapi eruption in Indonesia. International Journal of Disaster Risk Reduction, 13, 167–188.

Bakker, K., Kooy, M., Shofiani, N. E., & Martijn, E.-J. (2008). Governance failure: Rethinking the institutional dimensions of urban water supply to poor households. World Development, 36(10), 1891–1915.

Bakker, M. H. (2009). Transboundary River Floods and Institutional Capacity 1. JAWRA Journal of the American Water Resources Association, 45(3), 553-566.

Bangladesh Delta Plan. (2015). http://www.bangladeshdeltaplan2100.org.

Bangladesh Bureau of Statistics (BBS) (2011). Statistical Yearbook of Bangladesh. Statistics Division, Ministry of Planning, Dhaka, Government of the People's Republic of Bangladesh. Retrieved from http://203.112.218.65:8008/WebTestApplication/userfiles/Image/LatestReports/YB2011.pdf

Bangladesh Water Act (2013). Water resource and planning organization. Dhaka, Bangladesh: Government of Bangladesh. Retrieved from https://www.bwdb.gov.bd/archive/pdf/321.pdf

Benson, D., Gain, A., & Rouillard, J. (2015). Water governance in a comparative perspective: From IWRM to a 'nexus' approach? Water Alternatives, 8(1), 756-773.

Berkes, F. (2009). Evolution of co-management: Role of knowledge generation, bridging organizations and social learning. Journal of Environmental Management, 90(5), 1692–1702.

Berkes, F., & Ross, H. (2013). Community resilience: Toward an integrated approach. Society & Natural Resources, 26(1), 5–20. doi:10.1080/08941920.2012.736605.

Berkhout, F., Verbong, G., Wieczorek, A. J., Raven, R., Lebel, L., & Bai, X. (2010). Sustainability experiments in Asia: Innovations shaping alternative development pathways. Environmental Science & Policy, 13(4), 261–271.

Berrang-Ford, L., Pearce, T., & Ford, J. D. (2015). Systematic review approaches for climate change adaptation research. Regional Environmental Change, 15(5), 755–769.

Biesbroek, G.R., Termeer, C.J.a.M., Klostermann, J.E.M., Kabat, P., 2013. Analytical lenses on barriers in the governance of climate change adaptation. Mitig. Adapt. Strateg. Glob. Change 19, 1011–1032.Boyd

Biggs, E. M., Duncan, J. M., Atkinson, P. M., & Dash, J. (2013). Plenty of water, not enough strategy: How inadequate accessibility, poor governance and a volatile government can tip the balanceagainst ensuring water security: The case of Nepal. Environmental Science & Policy, 33, 388–394.

Binz, C., Truffer, B., Li, L., Shi, Y., & Lu, Y. (2012). Conceptualizing leapfrogging with spatially coupled innovation systems: The case of onsite wastewater treatment in China. Technological Forecasting and Social Change, 79(1), 155-171.

Birkmann, J., Garschagen, M., Kraas, F., & Quang, N. (2010). Adaptive urban governance: new challenges for the second generation of urban adaptation strategies to climate change. Sustainability Science, 5(2), 185-206.

Bird, J., Li, Y., Rahman, H. Z., Rama, M., & Venables, A. J. (2018). Dhaka: Dynamic but Messy. Retrieved from https://elibrary.worldbank.org/doi/abs/10.1596/978-1-4648-1238-5_ch1

Biswas, A.K. & Tortajada, C., (2010). Future Water Governance: Problems and Perspectives. International Journal of Water Resources Development, 26(2), pp.129–139.

Biswas, A. K. (2008). Integrated water resources management: Is it working? International Journal of Water Resources Development, 24(1), 5–22.

Biswas, A. K. (2006). Water management for major urban centres. Water Resources Development, 22(2), 183-197.

Blaikie, F. (2009). Knowing Bodies: A Visual and Poetic Inquiry into the Professoriate. International Journal of Education & the Arts, 10(8), n8.

Bown, N. K., Gray, T. S., & Stead, S. M. (2013). Co-management and adaptive co-management: Two modes of governance in a Honduran marine protected area. Marine Policy, 39, 128–134.

Brammer, H. (2004). Can Bangladesh be protected from floods? University Press. http://www.uplbooks.com/book/can-bangladesh-be-protected-floods

Brammer, H. (2010). After the Bangladesh flood action plan: Looking to the future. Environmental Hazards, 9(1), 118–130.

Briceno, C., Estache, A., & Shafik, N. T. (2004). Infrastructure services in developing countries: access, quality, costs, and policy reform. The World Bank. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.177.2357&rep=rep1&type=pdf

Brockerhoff, M. P. (2000). An urbanizing World. Population Bulletin, 55(3) (Population Reference Bureau).

Brown, R., Ashley, R., & Farrelly, M. (2011). Political and professional agency entrapment: An agenda for urban water research. Water Resources Management, 25(15), 4037–4050.

Brown, R., Farrelly, M., & Keath, N. (2009)a. Practitioner perceptions of social and institutional barriers to advancing a diverse water source approach in Australia. International Journal of Water Resources Development, 25(1), 15-28.

Brown, R. R., Keath, N., & Wong, T. H. (2009)b. Urban water management in cities: historical, current and future regimes. Water science and technology, 59(5), 847-855.

Brown, R. R. (2008). Local institutional development and organizational change for advancing sustainable urban water futures. Environmental management, 41(2), 221-233.

Brown, R. R., Sharp, L., & Ashley, R. M. (2006). Implementation impediments to institutionalising the practice of sustainable urban water management. Water Science and Technology, 54(6-7), 415-422.

Brunner, R. D., Steelman, T. A., Coe-Juell, L., Cromley, C. M., Tucker, D. W., & Edwards, C. M. (2005). Adaptive governance: Integrating science, policy, and decision making. New York: Columbia University Press.

Bryman, A. (2004). Qualitative research on leadership: A critical but appreciative review. The leadership quarterly, 15(6), 729-769.

Butler, J. R. A., Suadnya, W., Puspadi, K., Sutaryono, Y., Wise, R. M., Skewes, T. D., . . . Kisman, M. (2014). Framing the application of adaptation pathways for rural livelihoods and global change in eastern Indonesian islands. Global Environmental Change, 28, 368–382.

Celliers, L., Rosendo, S., Coetzee, I., & Daniels, G. (2013). Pathways of integrated coastal management from national policy to local implementation: Enabling climate change adaptation. Marine Policy, 39, 72–86.

Chaffin, B., Gosnell, H., & Cosens, B. A. (2014). A decade of adaptive governance scholarship: Synthesis and future directions. Ecology and Society, 19(3), 56.

Chan, N., Roy, R., & Chaffin, B. (2016). Water governance in Bangladesh: An evaluation of institutional and political context. Water, 8(9), 403.

Chocat, B., Ashley, R., Marsalek, J., Matos, M. R., Rauch, W., Schilling, W., & Urbonas, B. (2007). Toward the sustainable management of urban storm-water. Indoor and built environment, 16(3), 273-285.

Cinner, J. E., Daw, T. M., McClanahan, T. R., Muthiga, N., Abunge, C., Hamed, S., . . . Jiddawi, N. (2012). Transitions toward co-management: The process of marine resource management devolution in three east African countries. Global Environmental Change, 22(3), 651–658.

Clark, J. R., & Semmahasak, C. (2013). Evaluating adaptive governance approaches to sustainable water management in north-west Thailand. Environmental Management, 51(4), 882–896.

Clemens, M., Rijke, J., Pathirana, A., Evers, J., & Hong Quan, N. (2016). Social learning for adaptation to climate change in developing countries: Insights from Vietnam. Journal of Water and Climate Change, 7(2), 365–378.

Conway, D., & Mustelin, J. (2014). Strategies for improving adaptation practice in developing countries. Nature Climate Change, 4(5), 339.

Cosens, B. A. (2013). Legitimacy, adaptation, and resilience in ecosystem management. Ecology and Society, 18(1): 3.

Cooper, R. V. (2011). Promoting and contesting hydropower development: Actors and narratives in the lower Mekong basin's hydropolitical constellation (Ph.D. thesis). University of Newcastle. Retrieved from https://theses.ncl.ac.uk/dspace/bitstream/10443/1304/1/Cooper%2011.pdf.

Creswell, J. W. (2013). Research design: Qualitative, quantitative, and mixed methods approaches. Sage Publications.

Crona, B. I., & Parker, J. N. (2012). Learning in support of governance: Theories, methods, and a framework to assess how bridging organizations contribute to adaptive resource governance. Ecology and Society, 17(1): 32.

Cundill, G., Cumming, G., Biggs, D., & Fabricius, C. (2012). Soft systems thinking and social learning for adaptive management. Conservation Biology, 26(1), 13–20.

Denscombe, M. (2008). The length of responses to open-ended questions: A comparison of online and paper questionnaires in terms of a mode effect. Social Science Computer Review, 26(3), 359-368.

de Noronha, T., & Vaz, E. (2015). Framing urban habitats: The small and medium towns in the peripheries. Habitat International, 45, 147-155.

Dietz, T., Ostrom, E., & Stern, P. C. (2003). The struggle to govern the commons. Science, 302(5652), 1907-1912.

Dilley, P. (2004). Interviews and the philosophy of qualitative research. J. High. Educ. 75, 127–132.

Downs, T. (2001). Making sustainable development operational: integrated capacity building for the water supply and sanitation sector in Mexico. Journal of Environmental Planning and Management, 44(4), pp.525–544.

Easterly, W. (2009). How the millennium development goals are unfair to Africa. World development, 37(1), 26-35.

Easterly, W., Serven, L. (2003). The limits of stabilization: infrastructure, public deficits and growth in Latin America. World Bank Publications. Retrieved from http://documents.worldbank.org/curated/en/812361468773091055/pdf/271620PAPER0Limits0of0stabilization.pdf

Evans, L., Brown, K., & Allison, E. (2011). Factors influencing adaptive marine governance in a developing country context: A case study of Southern Kenya. Ecology and Society, 16(2): 21.

Falk, T., Bock, B., & Kirk, M. (2009). Polycentrism and poverty: Experiences of rural water supply reform in Namibia. Water Alternatives, 2(1), 115.

Farrelly, M. A., Rijke, J., & Brown, R. R. (2012). Exploring operational attributes of governance for change. In WSUD 2012: Water sensitive urban design; Building the water sensitive community; 7th international conference on water sensitive urban design (p. 244). Engineers Australia.

Farrelly, M., & Brown, R. (2011). Rethinking urban water management: experimentation as a way forward?. Global Environmental Change, 21(2), 721-732.

Ferguson, B. C., Brown, R. R., & Deletic, A. (2013). Diagnosing transformative change in urban water systems: Theories and frameworks. Global Environmental Change, 23(1), 264–280.

Folke, C. (2006). Resilience: The emergence of a perspective for social–Ecological systems analyses. Global Environmental Change, 16(3), 253–267.

Folke, C., Carpenter, S., Elmqvist, T., Gunderson, L., Holling, C. S., & Walker, B. (2002). Resilience and sustainable development: Building adaptive capacity in a world of transformations. AMBIO: A Journal of the Human Environment. 31(5), 437–441.

Folke, C., Carpenter, S., Walker, B., Scheffer, M., Elmqvist, T., Gunderson, L., & Holling, C. S. (2004). Regime shifts, resilience, and biodiversity in ecosystem management. Annual Review of Ecology, Evolution and Systematics, 35, 557–581.

Folke, C., Hahn, T., Olsson, P., & Norberg, J. (2005). Adaptive governance of social-ecological systems. The Annual Review of Environment and Resources, 30, 441–473.

Foxon, T. J., Reed, M. S., & Stringer, L. C. (2009). Governing long-term social–ecological change: what can the adaptive management and transition management approaches learn from each other?. Environmental Policy and Governance, 19(1), 3-20.

Frantzeskaki, N., Loorbach, D., & Meadowcroft, J. (2012). Governing societal transitions to sustainability. International Journal of Sustainable Development, 15(1-2), 19-36.

Galaz, V. (2007). Water governance, resilience and global environmental change–a reassessment of integrated water resources management (IWRM). Water Science and Technology, 56(4), 1-9.

Gain, A. K., & Schwab, M. (2012). An assessment of water governance trends: The case of Bangladesh. Water Policy, 14(5), 821–840.

Gauri, V., & Galef, J. (2005). NGOs in Bangladesh: Activities, resources, and governance. World Development, 33(12), 2045–2065.

Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study. Research Policy, 31(8), 1257–1274.

Geels, F. W. (2005). Technological transitions and system innovations: A coevolutionary and sociotechnical analysis. Edward Elgar Publishing.

Geels, F. W. (2006). The hygienic transition from cesspools to sewer systems (1840–1930): The dynamics of regime transformation. Research Policy, 35(7), 1069–1082.

Geels, F. W., & Raven, R. P. J. M. (2006). Non-linearity and expectations in niche development trajectories: ups and downs in Dutch biogas development (1973–2003). Technology Analysis & Strategic Management, 18(3/4), 375–392.

Girerdat, H. (1999). Creating sustainable cities. Totnes: Green Books
Gleick, P. H. (2003). Global freshwater resources: Soft-path solutions for the 21st century. Science, 302(5650), 1524–1528.

Grady, A., Gersonius, B., & Makarigakis, A. (2016). Taking stock of decentralized disaster risk reduction in Indonesia. Natural Hazards and Earth System Sciences, 16(9), 2145–2157.

Gumbo, B., Forster, L., & Arntzen, J. (2005). Capacity building in water demand management as a key component for attaining millennium development goals. Physics and Chemistry of the Earth, Parts A/B/C, 30(11-16), 984-992.

Gupta, J., Termeer, C., Klostermann, J., Meijerink, S., van Den Brink, M., Jong, P., . . . Bergsma, E. (2010). The adaptive capacity wheel: A method to assess the inherent characteristics of institutions to enable the adaptive capacity of society. Environmental Science & Policy, 13(6), 459–471.

Gupta, A. D., Babel, M. S., Albert, X., & Mark, O. (2005). Water sector of Bangladesh in the context of integrated water resources management: A review. International Journal of Water Resources Development, 21(2), 385–398.

GWP (2000). Global Water Partnership, Towards Water Security: A Framework for Action. Retrieved from https://www.gwp.org/globalassets/global/toolbox/references/towards-water-security.-a-framework-for-action.-mobilising-political-will-to-act-gwp-2000.pdf

GWP (2002). Global Water Partnership, Introducing Effective Water Governance, mimeo. Retrieved from
http://www.pacificwater.org/userfiles/file/IWRM/Toolboxes/High%20level%20engagement/Effective_Water_Governance.pdf

Hackenbroch, K., & Hossain, S. (2012). "The organised encroachment of the powerful"—Everyday practices of public space and water supply in Dhaka, Bangladesh. Planning Theory & Practice, 13(3), 397-420.

Halbe, J., Pahl-Wostl, C., Sendzimir, J., & Adamowski, J. (2013). Towards adaptive and integrated management paradigms to meet the challenges of water governance. Water Science & Technology, 67(11), 2651–2660.

Haq, K.A. (2006) Water management in Dhaka, International Journal of Water Resources Development, 22(2), pp.291-311.

Hansen, U. E., Nygaard, I., Romijn, H., Wieczorek, A., Kamp, L. M., & Klerkx, L. (2018). Sustainability transitions in developing countries: Stocktaking, new contributions and a research agenda. Environmental Science & Policy, 84, 198-203.

Hansen, U. E., & Nygaard, I. (2013). Transnational linkages and sustainable transitions in emerging countries: Exploring the role of donor interventions in niche development. Environmental Innovation and Societal Transitions, 8, 1-19.

Harrison, M. (1994). Public health in British India: Anglo-Indian preventive medicine 1859–1914. Cambridge University Press.

Hoko, Z. & Hertle, J., 2006. An evaluation of the sustainability of a rural water rehabilitation project in Zimbabwe. Physics and Chemistry of the Earth, 31(15-16), pp.699–706

Holtz, G., Brugnach, M., & Pahl-Wostl, C. (2008). Specifying ''regime"—A framework for defining and describing regimes in transition research. Technological Forecasting and Social Change, 75(5), 623–643.

Hossen, M. A., & Wagner, J. R. (2016). The need for community inclusion in water basin governance in Bangladesh. Bandung, 3(1), 1–17.

Hossain, M. A. A., Weng, T. K., & Mokhtar, M. (2012). Institutional aspects of water management: Evaluating the experience. Nova Science Publishers, Inc.

Huitema, D., Mostert, E., Egas, W., Moellenkamp, S., Pahl-Wostl, C., & Yalcin, R. (2009). Adaptive water governance: assessing the institutional prescriptions of adaptive (co-) management from a governance perspective and defining a research agenda. Ecology and society, 14(1), 26.

Huntjens, P., Lebel, L., Pahl-Wostl, C., Camkin, J., Schulze, R., & Kranz, N. (2012). Institutional design propositions for the governance of adaptation to climate change in the water sector. Global Environmental Change, 22(1), 67–81.

Hurlbert, M., & Gupta, J. (2017). The adaptive capacity of institutions in Canada, Argentina, and Chile to droughts and floods. Regional Environmental Change, 17(3), 865–877.

Hurlbert, M, & Gupta, J. (2016). Adaptive governance, uncertainty, and risk: policy framing and responses to climate change, drought, and flood. Risk Analysis, 36(2), 339–356.

Ison, R., Blackmore, C., & Iaquinto, B. L. (2013). Towards systemic and adaptive governance: exploring the revealing and concealing aspects of contemporary social-learning metaphors. Ecological Economics, 87, 34-42.

Jaglin, S., Repussard, C., & Belbéoc'h, A. (2011). Decentralisation and governance of drinking water services in small West African towns and villages (Benin, Mali, Senegal): the arduous process of building local governments. Canadian Journal of Development Studies/Revue canadienne d'études du développement, 32(2), 119-138.

Joint Monitoring program. (2009). WHO/UNICEF joint evaluation report for water supply in Bangladesh.

Karpouzoglou, T., Dewulf, A., & Clark, J. (2016). Advancing adaptive governance of social-ecological systems through theoretical multiplicity. Environmental Science & Policy, 57, 1–9.

Kemp, R., Parto, S., & Gibson, R. B. (2005). Governance for sustainable development: Moving from theory to practice. International Journal of Sustainable Development, 8(1–2), 12–30.
Keath, N. A., & Brown, R. R. (2009). Extreme events: Being prepared for the pitfalls with progressing sustainable urban water management. Water Science and technology, 59(7), 1271–1280.

Khan, M. M. (1997). Urban local governance in Bangladesh. In N. Islam & M. M. Khan (Eds.), Urban governance in Bangladesh and Pakistan. Dhaka, Bangladesh: Centre for Urban Studies.

Kooy, M., & Bakker, K. (2008). Splintered networks: The colonial and contemporary waters of Jakarta. Geoforum, 39, 1843–1858.

Koop, S. H., & van Leeuwen, C. J. (2015). Assessment of the sustainability of water resources management: a critical review of the city blueprint approach. Water Resources Management, 29(15), 5649-5670.

Kooiman, J., Jentoft, S., 2009. Meta-governance: values, norms and principles, and the making of hard choices. Public Administration 87, 818–836.

Kuzdas, C., Wiek, A., Warner, B., Vignola, R., & Morataya, R. (2015). Integrated and participatory analysis of water governance regimes: The case of the Costa Rican dry tropics. World Development, 66, 254–268.

Larsen, T. A., Hoffmann, S., Lüthi, C., Truffer, B., & Maurer, M. (2016). Emerging solutions to the water challenges of an urbanizing world. Science, 352(6288), 928-933.

Larson, S., Alexander, K. S., Djalante, R., & Kirono, D. G. (2013). The added value of understanding informal social networks in an adaptive capacity assessment: Explorations of an urban water management system in Indonesia. Water Resources Management, 27(13), 4425–4441.

Lawhon, M., & Murphy, J. T. (2011). Socio-technical regimes and sustainability transitions: Insights from political ecology. Progress in Human geography, 36(3), 354–378.

Lemos, M.C., Agrawal, A., 2006. Environmental governance. Annual Review of Environmental Resources 31, 297–325.

London, T., & Hart, S. L. (2004). Reinventing strategies for emerging markets: beyond the transnational model. Journal of international business studies, 35(5), 350-370.

Loorbach, D. (2007). Transition management: new mode of governance for sustainable development. Dutch Research Institute for Transitions (DRIFT). Retrieved from https://www.researchgate.net/publication/35149475_Transition_Management_New_Mode_of_Governance_for_Sustainable_Development

Loorbach, D., & Rotmans, J. (2010). The practice of transition management: Examples and lessons from four distinct cases. Futures, 42(3), 237–246.

Lubell, M., & Edelenbos, J. (2013). Integrated water resources management: A comparative laboratory for water governance. International Journal of Water Governance, 1(3-4), 177-196.

Lundvall, B. Å., Vang, J., Joseph, K. J., & Chaminade, C. (2009). Innovation system research and developing countries. Handbook of innovation systems and developing countries: Building domestic capabilities in a global setting, 1-30.

Lundqvist, J., Turton, A., & Narain, S. (2001). Social, institutional and regulatory issues. In Frontiers in urban water management: Deadlock or hope (pp. 344-398). IWA Publishing: London.

Malekpour, S., Brown, R. R., & de Haan, F. J. (2015). Strategic planning of urban infrastructure for environmental sustainability: Understanding the past to intervene for the future. Cities, 46, 67–75.

Marlow, D. R., Moglia, M., Cook, S., & Beale, D. J. (2013). Towards sustainable urban water management: A critical reassessment. Water research, 47(20), 7150-7161.

Marsalek, J., Rochfort, Q., Savic, D. (2001). Urban water as a part of integrated catchment management, in: Frontiers in Urban Water Management: Deadlock or Hope. IWA Publishing, London, pp. 37–83.

McKay, J. (2005). Water institutional reforms in Australia. Water policy, 7(1), 35-52.

Meadowcroft, J. (2005). Environmental political economy, technological transitions and the state. New Political Economy, 10, 479–498.

Meissner, R., & Turton, A. R. (2003). The hydrosocial contract theory and the Lesotho Highlands Water Project. Water Policy, 5, 115–126.

Medema, W., McIntosh, B., & Jeffrey, P. (2008). From premise to practice: a critical assessment of integrated water resources management and adaptive management approaches in the water sector. Ecology and Society, 13(2): 29.

Meuleman, L. (2008). Public management and the metagovernance of hierarchies, networks and markets: The feasibility of designing and managing governance style combinations. Springer Science & Business Media.

Mian, S. (2014). Pakistan's Flood Challenges: An assessment through the lens of learning and adaptive governance. Environmental Policy and Governance, 24(6), 423–438.

Milly, P. C., Betancourt, J., Falkenmark, M., Hirsch, R. M., Kundzewicz, Z. W., Lettenmaier, D. P., & Stouffer, R. J. (2008). Stationarity is dead: Whither water management?. Science, 319(5863), 573-574.

Ministry of Environment and Forest [MoEF]. (2009). Bangladesh Climate Change Strategy and Action Plan (BCCSAP). Dhaka: Government of Bangladesh. Retrieved from https://www.iucn.org/downloads/bangladesh_climate_change_strategy_and_action_plan_2009.pdf

Mistry, J., Berardi, A., Roopsind, I., Davis, O., Haynes, L., Davis, O., & Simpson, M. (2011). Capacity building for adaptive management: A problem-based learning approach. Development in Practice, 21(2), 190–204.

Mitchell, B. (2005). Integrated water resource management, institutional arrangements, and land-use planning. Environment and Planning A, 37(8), 1335.

Moinuddin, G. (2013). Urban basic utilities management under fragmented governance: an oratory on its contribution in cities of developing world. Theoretical & Empirical Researches in Urban Management, 8(4).

Moinuddin, G. (2010). Metropolitan government and improvement potentials of urban basic services governance in Dhaka city, Bangladesh: Rhetoric or Reality? Theoretical and Empirical Researches in Urban Management, 5(14), 59–81.

Multiple Indicator Cluster Survey (MICS). (2009). New York: United Nations Children's Fund, Bangladesh & Bangladesh Bureau of Statistics; 2010. Retrieved from https://mics.unicef.org/files?job=W1siZiIsIjIwMTUvMDcvMDcvMTcvMjAvMDkvNzk2L0JhbmdsYWRlc2hfMjAxMl8xM19NSUNTX0ZpbmFsX1JlcG9ydC5wZGYiXV0&sha=f6f33951c5125263

Mugabi, J., Kayaga, S., Njiru, C., 2007. Strategic planning for water utilities in developing countries. Util. Policy 15, 1–8.

Mymensingh Strategic development Plan (MSDP) (2011 -2031). Retrieved from http://udd.portal.gov.bd/sites/default/files/files/udd.portal.gov.bd/publications/c02c0a00_4471_4763_8659_7e04028b0cb5/MSDP%20Monograph.pdf .

Nastar, M. (2014). What drives the urban water regime? An analysis of water governance arrangements in Hyderabad, India. Ecology and Society, 19(2), 57.

Nagendra, H., Bai, X., Brondizio, E. S., & Lwasa, S. (2018). The urban south and the predicament of global sustainability. Nature Sustainability, 1(7), 341-349.

Newman, M. E. (2001). The structure of scientific collaboration networks. Proceedings of the National Academy of Sciences, 98(2), 404–409.

Newig, J., & Koontz, T. M. (2014). Multi-level governance, policy implementation and participation: The EU's mandated participatory planning approach to implementing environmental policy. Journal of European Public Policy, 21(2), 248–267.

Nguyen, Q. A., Miller, F., Bowen, K., & Tan Sinh, B. (2017). Evaluating capacity for climate change adaptation in the health and water sectors in Vietnam: Constraints and opportunities. Climate and Development, 9(3), 258–273.

Nowreen, S. M., Khan, S. A., & Huq, H. (2011). Development of an operational IWRM framework in a selected small scale water resources development sector project in Bangladesh. South Asian Water Studies, 2(2), 6–26.

Novalia, W., Brown, R. R., Rogers, B. C., & Bos, J. J. (2018). A diagnostic framework of strategic agency: Operationalising complex interrelationships of agency and institutions in the urban infrastructure sector. Environmental science & policy, 83, 11-21.

OECD (2015). OECD principles on water governance, note by the secretary-general, doc C (2015) 71 Ref: JT03376062). Paris: OECD Publishing. Retrieved from https://www.oecd.org/cfe/regional-policy/OECD-Principles-on-Water-Governance.pdf

OECD (2011). Water governance in OECD countries: A multi-level approach, OECD studies on water. Paris: OECD Publishing. Retrieved from https://www.oecd.org/governance/regional-policy/48885867.pdf

Ojendal, J., Hansson, S., & Hellberg, S. (2012). Politics and Development in a Transboundary Watershed. Springer Publication.

Olsson, P., Folke, C., & Berkes, F. (2004). Adaptive comanagement for building resilience in social–Ecological systems. Environmental Management, 34(1), 75–90.

Orchard, S. E., Stringer, L. C., & Quinn, C. H. (2015). Impacts of aquaculture on social networks in the mangrove systems of northern Vietnam. Ocean & Coastal Management, 114, 1–10.

Ostrom, E. (2010). Polycentric systems for coping with collective action and global environmental change. Global Environmental Change, 20(4), 550–557.

Owusu, G. (2005). Small towns in Ghana: justifications for their promotion under Ghana's decentralisation programme. African Studies Quarterly, 8(2), 48-69.

Pahl-Wostl, C. (2017). An evolutionary perspective on water governance: from understanding to transformation. Water Resources Management, 31(10), 2917-2932.

Pahl-Wostl, C. (2015). Water governance in the face of global change. Springer International Publishing: Switzerland. doi, 10, 978-3.

Pahl-Wostl, C., Lebel, L., Knieper, C., Nikitina, E. (2012). From applying panaceas to mastering complexity: toward adaptive water governance in river basins. Environ. Sci. Policy 23, 24–34.

Pahl-Wostl, C., Holtz, G., Kastens, B., & Knieper, C. (2010). Analyzing complex water governance regimes: The management and transition framework. Environmental Science & Policy, 13(7), 571–581.

Pahl-Wostl, C. (2009). A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes. Global Environmental Change, 19(3), 354–365.

Pahl-Wostl, C. (2008). Requirements for adaptive water management. Adaptive and integrated water management. Springer.

Pahl-Wostl, C., Craps, M., Dewulf, A., Mostert, E., Tabara, D., & Taillieu, T. (2007). Social learning and water resources management. Ecology and society, 12(2).

Pahl-Wostl, C. (2007). Transitions towards adaptive management of water facing climate and global change. Water Resources Management, 21(1), 49–62.

Pahl-Wostl, C., & Sendzimir, J. (2005). The relationship between IWRM and Adaptive Water Management. NeWater Working Paper No 3. Retrieved from https://pdfs.semanticscholar.org/870a/053367d5bb54d23b6120af3db4140cfda87f.pdf

Panditharatne, C. (2016). Institutional barriers in adapting to climate change: A case study in Sri Lanka. Ocean & Coastal Management, 130, 73–78.

Pant, L. P. (2016). Paradox of mainstreaming agroecology for regional and rural food security in developing countries. Technological Forecasting and Social Change, 111, 305–316.

Pant, L. P., Adhikari, B., & Bhattarai, K. K. (2015). Adaptive transition for transformations to sustainability in developing countries. Current Opinion in Environmental Sustainability, 14, 206-212.

Pant, L. P., KC, K. B., Fraser, E. D., Shrestha, P. K., Lama, A. B., Jirel, S. K., & Chaudhary, P. (2014). Adaptive transition management for transformations to agricultural sustainability in the Karnali Mountains of Nepal. Agroecology and Sustainable Food Systems, 38(10), 1156–1183.

Patton, M. Q. (2002). Two decades of developments in qualitative inquiry: A personal, experiential perspective. Qualitative social work, 1(3), 261-283.

Pérez-Latre, F. J., Portilla, I., & Blanco, C. S. (2011). Social networks, media and audiences: A literature review. Comunicación y Sociedad; Pamplona, 24(1), 63–74.

Pierre, J., Peters, B.G. (2000). Governance, Politics and the State. Macmillan, Basingstoke, Hampshire, UK

Plummer, M. L. (2009). Assessing benefit transfer for the valuation of ecosystem services. Frontiers in Ecology and the Environment, 7, 38–45.

Plummer, R., Armitage, D., & De Loë, R. (2013). Adaptive comanagement and its relationship to environmental governance. Ecology and Society, 18(1).

Poustie, M. S., Frantzeskaki, N., & Brown, R. R. (2016). A transition scenario for leapfrogging to a sustainable urban water future in Port Vila, Vanuatu. Technological Forecasting and Social Change, 105, 129-139.

Poustie, M. S., Deletic, A., Brown, R. R., Wong, T., de Haan, F. J., & Skinner, R. (2015). Sustainable urban water futures in developing countries: the centralised, decentralised or hybrid dilemma. Urban Water Journal, 12(7), 543-558.

Rabbani, G. (2011). Water supply in Dhaka in Pakistan period. Bangladesh Asiatic Society Press.

Rahman, R., Haque, A., Khan, S. A., Salehin, M., & Bala, S. K. (2005). Investigation of hydrological aspects of flood-2004 with special emphasis on Dhaka city. Final Report. Dhaka: Institute of Water and Flood Management, Bangladesh University of Engineering and Technology.

Rana, M. P. (2011). Urbanization and sustainability: Challenges and strategies for sustainable urban development in Bangladesh. Environmental Development & Sustainability, 13, 237–256.

Rana, M. M. P. (2009). Sustainable city in the global North and South: goal or principle. Management of Environmental Quality: An International Journal, 20(5), 506–521.

Ranabhat, S., Ghate, R., Bhatta, L. D., Agrawal, N. K., & Tankha, S. (2018). Policy coherence and interplay between climate change adaptation policies and the forestry sector in Nepal. Environmental Management, 61(6), 968–980.

Raven, R., & Geels, F. W. (2010). Socio-cognitive evolution in niche development: Comparative analysis of biogas development in Denmark and the Netherlands (1973–2004). Technovation, 30(2), 87–99.

Raven, R., Kern, F., Smith, A., Jacobsson, S., & Verhees, B. (2016). The politics of innovation spaces for low-carbon energy: Introduction to the special issue. Environmental Innovation and Societal Transitions, 18, 101–110.

Reed, M., Evely, A. C., Cundill, G., Fazey, I. R. A., Glass, J., Laing, A., ... & Stringer, L. (2010). What is social learning?. Ecology and society. 15(4), r1.

Regmi, B. R., Star, C., & Leal Filho, W. (2016). Effectiveness of the local adaptation plan of action to support climate change adaptation in Nepal. Mitigation and Adaptation Strategies for Global Change, 21(3), 461–478.

Rijke, J., Brown, R., Zevenbergen, C., Ashley, R., Farrelly, M., Morison, P., & van Herk, S. (2012). Fit-for-purpose governance: A framework to make adaptive governance operational. Environmental Science Policy, 22, 73–84.

Rip, A., Kemp, R. P. M., & Kemp, R. (1998). Technological change. In S. Rayner, & E. L. Malone (Eds.), Human choice and climate change. Vol. II, Resources and Technology (pp. 327-399). Columbus, Ohio: Battelle Press.

Rist, S., Chidambaranathan, M., Escobar, C., Wiesmann, U., & Zimmermann, A. (2007). Moving from sustainable management to sustainable governance of natural resources: The role of social learning processes in rural India, Bolivia and Mali. Journal of rural studies, 23(1), 23-37.

Rock, M., Murphy, J. T., Rasiah, R., van Seters, P., & Managi, S. (2009). A hard slog, not a leap frog: Globalization and sustainability transitions in developing Asia. Technological Forecasting and Social Change, 76(2), 241-254.

Rogers, P., & Hall, A. W. (2003). Effective water governance (Vol. 7). Stockholm: Global water partnership. Retrieved from https://www.gwp.org/globalassets/global/toolbox/publications/background-papers/07-effective-water-governance-2003-english.pdf

Romano, O., & Akhmouch, A. (2019). Water Governance in Cities: Current Trends and Future Challenges. Water, 11(3), 500.

Rondinelli, D. A. (1983). Towns and small cities in developing countries. Geographical Review, 379-395.

Rotmans, J., Kemp, R., & Van Asselt, M. (2001). More evolution than revolution: Transition management in public policy. Foresight, 3(1), 15–31.

Rouillard, J. J., Benson, D., & Gain, A. K. (2014). Evaluating IWRM implementation success: Are water policies in Bangladesh enhancing adaptive capacity to climate change impacts? International Journal of Water Resources Development, 30(3), 515–527.

SACOSAN-VI, Bangladesh Country paper. (2016). Sixth South Asian Conference on Sanitation. Retrieved from http://www.sacosanvi.gov.bd/data/frontImages/Bangladesh_Country_Paper.pdf .

Satumanatpan, S., Senawongse, P., Thansuporn, W., & Kirkman, H. (2014). Enhancing management effectiveness of environmental protected areas, Thailand. Ocean & Coastal Management, 89, 1–10.

Saunders, M., Lewis, P., Thornhill, A., & Wilson, J. (2009). Business research methods. Financial Times, Prentice Hall: London. Retrieved from https://eclass.teicrete.gr/modules/document/file.php/DLH105/Research%20Methods%20for%20Business%20Students%2C%205th%20Edition.pdf

Scholz, R. W., & Binder, C. R. (2011). *Environmental literacy in science and society: from knowledge to decisions*. Cambridge University Press.

Sectoral Development Plan-Water and Sanitation (2010). Ministry of local government, rural development and cooperatives. Government of the People's Republic of Bangladesh. Retrieved from https://itn.buet.ac.bd/publications/sector-documents/documents/sdpengsum.pdf.

Sectoral Development Plan (2015). Ministry of local government, rural development and cooperatives. Government of the People's Republic of Bangladesh.

Seeliger, L., & Turok, I. (2014). Averting a downward spiral: Building resilience in informal urban settlements through adaptive governance. Environment and Urbanization, 26(1), 184–199.

Sengers, F., Wieczorek, A. J., & Raven, R. (2016). Experimenting for sustainability transitions: A systematic literature review. Technological Forecasting and Social Change. 145(August 2019), 153-164.

Sharma-Wallace, L., Velarde, S. J., & Wreford, A. (2018). Adaptive governance good practice: Show me the evidence!. Journal of environmental management, 222, 174-184.

Shackleton, C. M., Cundill, G., & Knight, A. T. (2009). Beyond just research: experiences from Southern Africa in developing social learning partnerships for resource conservation initiatives. Biotropica, 41(5), 563-570.

Sheesh, K. M. (2011). Water Supply in Dhaka in Bangladesh Period. Asiatic Society Bangladesh.

Shrestha, M. K. (2013). Internal versus external social capital and the success of community initiatives: A case of self-organizing collaborative governance in Nepal. Public Administration Review, 73(1), 154–164.

Smith, A., & Raven, R. (2012). What is protective space? Reconsidering niches in transitions to sustainability. Research Policy, 41(6), 1025–1036.

Smith, A., Stirling, A., (2010). The politics of social-ecological resilience and sustainable socio-technical transitions. Ecol. Soc. 15, 11.

Smith, A., Stirling, A., & Berkhout, F. (2005). The governance of sustainable socio-technical transitions. Research policy, 34(10), 1491-1510.

Sowman, M., & Raemaekers, S. (2018). Socio-ecological vulnerability assessment in coastal communities in the BCLME region. Journal of Marine Systems, 188, 160–171.

Srinivasan, V., Seto, K. C., Emerson, R., & Gorelick, S. M. (2013). The impact of urbanization on water vulnerability: A coupled human–Environment system approach for Chennai, India. Global Environmental Change, 23(1), 229–239.

Srinivasan, V. (2015). Reimagining the past–use of counterfactual trajectories in socio-hydrological modelling: the case of Chennai, India. Hydrology and Earth System Sciences, 19(2), 785–801
Sultana, P., Thompson, P., & Green, C. (2011). Can England learn lessons from Bangladesh in introducing participatory floodplain management? Water Resources Management, 22(3), 357–376.

Starkl, M., Brunner, N., Lopez, E., & Martínez-Ruiz, J. L. (2013). A planning-oriented sustainability assessment framework for peri-urban water management in developing countries. water research, 47(20), 7175-7183.

Sultana, P., Thompson, P., & Green, C. (2008). Can England learn lessons from Bangladesh in introducing participatory floodplain management? Water Resources Management, 22(3), 357–376.

Tortajada, C. (2008). Challenges and realities of water management of megacities: the case of Mexico City Metropolitan Area. Journal of international affairs, 147-166.

Turton, A. R., & Ohlsson, L. (1999). Water scarcity and social adaptive capacity: Towards an understanding of the social dynamics of managing water scarcity in developing countries. Paper presented at the Stockholm Water Symposium 9–12.

Tutusaus, M., & Schwartz, K. (2018). Water services in small towns in developing countries: at the tail end of development. Water Policy, 20(S1), 1-11.

Turner III, D.W., 2010. Qualitative interview design: A practical guide for novice investigators. Qual. Rep. 15, 754–760.

Turner, B. L., Matson, P. A., McCarthy, J. J., Corell, R. W., Christensen, L., Eckley, N., ... & Martello, M. L. (2003). Illustrating the coupled human–environment system for vulnerability analysis: three case studies. Proceedings of the National Academy of Sciences, 100(14), 8080-8085.

Turnheim, B., & Geels, F. W. (2013). The destabilisation of existing regimes: Confronting a multi-dimensional framework with a case study of the British coal industry (1913–1967). Research Policy, 42(10), 1749-1767.

United Nations, Department of Economic and Social Affairs, Population Division (2019). World Population
Prospects 2019: Highlights (ST/ESA/SER.A/423). Retrieved from
https://population.un.org/wpp/Publications/Files/WPP2019_Highlights.pdf

United Nation, Department of Economic and Social Affairs, Population Division (2018). World Urbanisation Prospects: the 2017 revision. New York:,, United Nations. Retrieved from
https://population.un.org/wup/Publications/Files/WUP2018-Report.pdf.

United Nation, Department of Economic and Social Affairs (2018). World economic situation and prospects. New York: United Nations. Retrieved from https://www.un.org/development/desa/dpad/wp content/uploads/sites/45/publication/WESP2018_Full_Web-1.pdf.

United Nation (2015). Transforming our world: The 2030 agenda for sustainable development. New York: United Nations. Retrieved from http://bit.ly/TransformAgendaSDG-pdf.

United Nations, Department of Economic and Social Affairs, Population Division (2015). World Urbanization Prospects: The 2014 Revision, (ST/ESA/SER.A/366). Retrieved from
https://population.un.org/wup/Publications/Files/WUP2014-Report.pdf

Unruh G (2000) Understanding carbon lock-in. Energ Pol 28:817–830.

UNICEF Bangladesh. (2015). Sanitation in Bangladesh: Past learning and future opportunities. Retrieved   from
https://www.researchgate.net/publication/316669410_Sanitation_in_Bangladesh_Past_Learning_and_Future_Opportunities.

UNICEF Bangladesh. (2010). A case for geographic targeting of basic social services to mitigate inequalities in Bangladesh. Retrieved from https://www.unicef.org/socialpolicy/files/A_Case_for_Geographic_Targeting_of_Social_Services_to_Accelerate_Poverty_Reduction_in_Bangladesh.pdf.

Van der Brugge, R., & Rotmans, J. (2007). Towards transition management of European water resources. Water Resources Management, 21(1), 249–267.

Van de Poel, I. (2000). On the role of outsiders in technical development. Technology Analysis & Strategic Management, 12(3), 383–397.

Van der Brugge, R., & Van Raak, R. (2007). Facing the adaptive management challenge: insights from transition management. Ecology and Society, 12(2).

Van de Meene, S. J., Brown, R. R., & Farrelly, M. A. (2011). Towards understanding governance for sustainable urban water management. Global Environmental Change, 21(3), 1117–1127.

Van de Meene, S. J., Brown, R. R., & Farrelly, M. A. (2010). Capacity attributes of future urban water management regimes: projections from Australian sustainability practitioners. Water Science and Technology, 61(9), 2241-2250.

Vargas, R., Alcaraz-Segura, D., Birdsey, R., Brunsell, N. A., Cruz-Gaistardo, C. O., de Jong, B., . . .Loescher, H. W. (2017). Enhancing interoperability to facilitate implementation of REDD+: Case study of Mexico. Carbon Management, 8(1), 57–65.

Verbong, G. P., & Geels, F. W. (2010). Exploring sustainability transitions in the electricity sector with socio-technical pathways. Technological Forecasting and Social Change, 77(8), 1214-1221.

Walch, C. (2019). Adaptive governance in the developing world: Disaster risk reduction in the State of Odisha, India. In Climate and Development (pp. 1–15).

Walker, B., Holling, C. S., Carpenter, S. R., & Kinzig, A. (2004). Resilience, adaptability and transformability in social–Ecological systems. Ecology and Society, 9(2), 5.

Watson, J., & Sauter, R. (2011). Sustainable innovation through leapfrogging: a review of the evidence. International Journal of Technology and Globalisation, 5(3-4), 170-189.

Water Resources Planning Organization [WaRPO]. (2001). National water management plan: Volume 1 – summary. Dhaka: Government of Bangladesh.

Wieczorek, A. J. (2018, Jun). Sustainability transitions in developing countries: Major insights and their implications for research and policy. Environmental Science & Policy, 1(84), 204–216.

Wieczorek, A. (2017). Sustainability transitions in developing countries: Major insights and their implications for research and policy. Environmental Science and Policy.

Wilder, M. & Romero Lankao, P., 2006. Paradoxes of decentralization: Water reform and social implications in Mexico. World Development, 34(11), pp.1977–1995.

Winkel, T., Bommel, P., Chevarría-Lazo, M., Cortes, G., Del Castillo, C., Gasselin, P., . . . Tourrand, J. F. (2016). Panarchy of an indigenous agroecosystem in the globalized market: The quinoa production in the Bolivian Altiplano. Global Environmental Change, 39, 195–204.

Wittmayer, J. M., Schäpke, N., van Steenbergen, F., & Omann, I. (2014). Making sense of sustainability transitions locally: how action research contributes to addressing societal challenges. Critical policy studies, 8(4), 465-485.

WHO/UNICEF (2017). Progress on Drinking Water, Sanitation and Hygiene: 2017 Update and SDG Baselines. Geneva: World Health Organization (WHO) and the United Nations Children's Fund (UNICEF), 2017. Retrieved from https://www.who.int/mediacentre/news/releases/2017/launch-version-report-jmp-water-sanitation-hygiene.pdf.

Wolfram, M. (2016). The role of cities in sustainability transitions: New perspectives for science and policy. In E. Kim & B. H. S. Kim (Eds.), Quantitative regional economic and environmental analysis for sustainability in Korea (pp. 3–22). Singapore: Springer.

Wong, T. H., & Brown, R. R. (2009). The water sensitive city: principles for practice. Water science and technology, 60(3), 673-682.

Wubneh, M., 2003. Building capacity in Africa: The impact of institutional, policy and resource factors. African Development Review, 15(2-3), pp.165–198.

Yin, R.K., 2013. Case study research: Design and methods. Sage publications.

Yin RK (2009) Case Study Research: Design and Methods. Fourth edition. Sage Publications, Thousand Oaks CA

Yoseph-Paulus, R., & Hindmarsh, R. (2018). Addressing inadequacies of sectoral coordination and local capacity building in Indonesia for effective climate change adaptation. Climate and Development, 10(1), 35–48

Appendix

Research ethics forms

MONASH University

CONSENT FORM

(Persons participating in research interview)

Project: 'Water Sensitive Cities in developing countries: identifying opportunities by diagnosing institutional path dependencies

Chief Investigator: Dr Megan Farrelly

- I have read the Participant Explanatory Statement in a language that I understand.

- I understand the purpose and procedures of the research described in the project.

- I have had an opportunities to ask questions and I am satisfied with the answers that I have received.

- I voluntarily agree to be a participant in this research project as described in the explanatory statement, and understand that I can withdraw my consent form the research at any time during the project.

- I understand that I will be given a signed copy of this document to keep.

I consent to the following:	Yes	No
Audio recording during the interview/focus group	☐	☐
Taking part in a focus group of up to 4 people	☐	☐
The data that I provide during this research may be used by the lead researchers in future research projects	☐	☐

Name of Participant _____

Participant Signature _____   Date _____

EXPLANATORY STATEMENT

(Persons participating in research interview)

Project Title: 'Water Sensitive Cities in developing countries: identifying opportunities by diagnosing institutional path dependencies'.

Project Number: (This number will be provided by MUHREC upon receipt of the application)

Tahmina Yasmin (PhD Candidate)	**Dr Megan Farrelly (Supervisor)**
School of Social Science	School of Social Science
Faculty of Arts	Faculty of Arts
Phon███████████	Ph: ███████████
Email: ███████████	Email: ███████████

You are invited to take part in this study. Please read this Explanatory Statement in full before deciding whether or not to participate in this research. If you would like further information regarding any aspect of this project, you are encouraged to contact us via the phone numbers or email addresses listed above.

What does the research involve?

The aim of this research is to design an adaptive governance framework that can be used to assist in delivering improved urban water servicing within Bangladesh, particularly the rapidly growing secondary cities such as Mymensingh. This will involve an historical and contemporary assessment of urban water servicing practices and an analysis of the degree to which contemporary practices utilise adaptive governance mechanisms. Ultimately, this project will work towards helping water practitioners to equitably delivery more sustainable services related to drinking water supplies, sanitation and drainage.

To achieve this aim, Participants will be asked to take part in individual interviews and focus group discussions related to the topic of urban water servicing (infrastructure, planning, service delivery etc.).

Why were you chosen for this research?

You have been selected to participate in this research based on your role within the Mymensingh Municipality water related service delivery unit. From initial discussions with your higher management authority and relevant community organizations and leaders you have been nominated as someone who would be able to provide pertinent insights for my research project.

Consenting to participate in the project and withdrawing from the research

  (i) Consenting to take part in this research process is **completely voluntary,** and at any stage during data collection, you can choose to withdraw without prejudice**;**
  (ii) Should you choose to withdraw, any data collected from you will be permanently destroyed along with your original consent form.
  (iii) Once the de-identified data has been collected, analysed and published, withdrawal will no longer be possible.
  (iv) You will be asked to sign and return the attached consent form;
  (v) Those who do not wish to participate in interviews and focus groups may still be able to contribute to the project through informal conversations with the researcher.

Possible benefits and risks to participants

It is anticipated that this research will have a number of societal and individual benefits. Participants are able to share their reflective insights and experience in a confidential manner. This data will then be used to produce a tool to assist in strengthening their capacity in urban water governance activities. Societal benefits, may not be immediate, but ultimately will relate to the improved management of a critical natural resource – water. This work will help to shape activities that ensures the sustainable use and delivering of urban water in a more bottom-up, context-sensitive manner.

The research is focused on exploring the appropriate mode of management practice to guide sustainable service delivery options, and as such will require participants to reflect on their own (and collective) work-based practices related to the broad urban water management approaches. If at any stage the researcher identifies a participant is uncomfortable with a line of questioning, the participant will be reminded that they can refrain from answering a particular question, or withdraw their participation from the research.

Confidentiality
A number of steps are taken to ensure the confidentiality of the data collected throughout the research process. Interviews are audio recorded and once transcribed the original audio file will be destroyed. In focus groups participants will be able to identify one another, but similar to the interviews, once transcribed, the original audio recordings will be destroyed. When published individuals will be referred to by either pseudonyms or participants codes, with specific information about position and roles in the organization that could be used to identify individuals omitted. Data will be published in peer-reviewed academic journals, international conference papers/presentations, and as a doctoral thesis.

Storage of data
Data in the context of this research includes interview and focus group transcripts, audio recordings, filed notes gathered through participation and observation in governance activities. This data will be stored in a password protected storage device. A previously mentioned, audio recordings will be destroyed once transcribed, while transcript will be securely stored for future reference.

Results
Results will be published via peer-reviewed journals, as conference papers, and as a thesis. Each publication will be made available to participants directly from the researcher, or through academic databases in the case of copyrighted, published journal articles.

Complaints
Should you have any concerns or complaints about the conduct of the project, you are welcome to contact either

Thank you,

Dr. Megan Farrelly (Lead researcher)

Tahmina Yasmin (Student)