

Changing lake governance in areas under urban transformation: Cases
from the Greater Bengaluru Metropolitan Region, India

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Abstract

We live in an era of urbanisation, where urban centres are the major drivers of economic development. This is more so the case in the Global South, where the cities are growing exponentially while the governance and infrastructure systems are unable to adapt. Urban transformation has far-reaching implications on ecosystems, especially common pool resources (lakes, forests, grazing lands...) not just within the boundaries but surrounding areas as well. A great deal of attention has been given to study commons in both rural and the impact of urban development on changes in the biophysical and ecosystem services. There is, however, limited focus on how urban development leads to changes in institutions in managing commons such as lakes in areas of urban transformation. This dissertation contributes to the literature by focusing on institutions and actors as the centre of analysis, by addressing three interrelated objectives across three interconnected lakes along a rural-urban gradient in the Greater Bengaluru Metropolitan Region, India. It investigates how communities negotiate institutional arrangements in view of changing distributional outcomes and power asymmetries. It examines the pre-conditions of legitimacy, shared understanding and exchange of resources facilitate co-management of lakes. It focuses on understanding the role of bridging actors in shaping networks of actors involved in co-management of lakes. To understand the above objectives, I draw on the Bloomington School of Political Economy, applying a conceptual framework of polycentric governance. This framework enables to analyse how formal and informal rules, changes in the biophysical contexts and actor characteristics influence negotiations and development of alternative institutional arrangements.

The results show that urban transformation has influenced a shift in the management practices of lakes in the region. There has been a shift in lake management from the 1960s where lakes were considered as a state managed resource to 2018, where there is a push for co-management of lakes. This change in management is the result of changes in the distributional outcome of communities (non-state actors) leading to the negotiation of a co-managed institutional arrangement. Though there is a difference in the negotiation of alternate institutional arrangements across the rural-urban gradient, it is highlighted that heterogeneity influences community engagement and involvement in co-managing lakes by increasing transaction costs. The role of state becomes crucial in facilitating co-management in urban and peri-urban areas to provide legitimacy to non-state actors, especially to third-sector organisations, including non-governmental organisations. The non-state actors, mainly the third-sector organisations, help in realigning actor preferences by developing shared understanding across actors. Further, these actors also facilitate development of networks of actors (state and non-state) leading to holistic lake management.

The findings of the study emphasize the practical implications for policies and strategies in urban planning in the greater Bengaluru Metropolitan region and beyond. The rapid and unplanned expansion of cities necessitates the need for incorporating not just management of common-pool resources in development plans, but also the roles of state and non-state actors. This inclusion of actors requires the state to consider and enable participation of non-state actors in planning and implementation of activities for managing common-pool resources by providing adequate institutional support. Further, there is also a need for development of a common problem definition and realignment of actor goals when managing common-pool resources such as lakes, which are interconnected in nature and not bound by administrative boundaries, leading to holistic development.

Zusammenfassung

Wir leben in einer Ära der Urbanisierung, in der die städtischen Zentren die wichtigsten Motoren der wirtschaftlichen Entwicklung sind. Dies betrifft insbesondere den Globalen Süden, wo die Städte exponentiell wachsen, während die Regierungs- und Verwaltungsstrukturen sowie Infrastruktursysteme nicht in der Lage sind, sich anzupassen. Der städtische Wandel hat weitreichende Auswirkungen auf die Ökosysteme, insbesondere auf die gemeinsamen Ressourcen (Seen, Wälder, Weideland usw.), und zwar nicht nur innerhalb der Stadtgrenzen, sondern auch in den umliegenden Gebieten. Der Untersuchung von Gemeingütern in ländlichen Gebieten und den Auswirkungen der städtischen Entwicklung auf Veränderungen der biophysikalischen und Ökosystemdienstleistungen wurde viel Aufmerksamkeit geschenkt. Die Frage, wie die städtische Entwicklung zu Veränderungen in Institutionen für die Verwaltung von Gemeingütern wie Seen in städtischen Transformationsgebieten führt, ist jedoch nur begrenzt untersucht worden. Diese Dissertation leistet einen Beitrag zur Literatur, indem sie Institutionen und Akteure in den Mittelpunkt der Analyse stellt und drei miteinander verknüpfte Ziele an drei miteinander verbundenen Seen entlang eines ländlich-urbanen Gradienten in der Metropolregion Bengaluru, Indien, verfolgt. Sie untersucht, wie Gemeinschaften institutionelle Übereinkommen im Hinblick auf sich verändernde Verteilungsergebnisse und Machtasymmetrien aushandeln. Es wird analysiert, unter welchen Voraussetzungen Legitimität, gemeinsames Verständnis und Austausch von Ressourcen das Co-Management von Seen erleichtern. Der Schwerpunkt liegt auf dem Verständnis der Rolle von sogenannten Brückenakteuren bei der Gestaltung von Netzwerken von Akteuren, die am Co-Management von Seen beteiligt sind. Um die oben genannten Ziele zu erreichen, stütze ich mich auf die *Bloomington School of Political Economy* und wende ein Rahmenkonzept der polyzentrischen Governance an. Dieser Rahmen ermöglicht es zu analysieren, wie formelle und informelle Regeln, Veränderungen im biophysikalischen Kontext und die Eigenschaften der Akteure die Verhandlungen und die Entwicklung alternativer institutioneller Vereinbarungen beeinflussen.

Die Ergebnisse zeigen, dass die urbane Transformation einen Wandel in der Bewirtschaftung der Seen in der Region bewirkt hat. Die Verwaltung der Seen hat sich seit den 60er Jahren, in denen Seen als staatlich verwaltete Ressource betrachtet wurden, bis hin zum Jahr 2018, wo es einen Vorstoß in Richtung Co-Management von Seen gibt, verändert. Dieser Wandel in der Verwaltung ist das Ergebnis von Veränderungen in den Verteilungsergebnissen der Gemeinschaften (nichtstaatliche Akteure), die zu Verhandlungen über eine institutionelle Vereinbarung zur gemeinsamen Verwaltung führen. Obwohl es Unterschiede bei der Aushandlung alternativer institutioneller Übereinkommen über das Land-Stadt-Gefälle hinweg gibt, wird hervorgehoben, dass die Heterogenität das Engagement und die Beteiligung der Gemeinden an der gemeinsamen Bewirtschaftung von Seen durch die Erhöhung der Transaktionskosten beeinflusst. Die Rolle des Staates ist bei der Erleichterung des Co-Managements in städtischen und stadtnahen Gebieten entscheidend, um nichtstaatlichen Akteuren, insbesondere *Third-sector organisations* einschließlich Nichtregierungsorganisationen, Legitimität zu verleihen. Die nichtstaatlichen Akteure, vor allem die *Third-sector organisations*, tragen dazu bei, die Präferenzen der Akteure neu auszurichten, indem sie ein gemeinsames Verständnis der Akteure entwickeln. Darüber hinaus erleichtern diese Akteure auch die Entwicklung von Netzwerken von (staatlichen und nichtstaatlichen) Akteuren, die zu einem ganzheitlichen Seenmanagement führen.

Die Ergebnisse der Studie haben praktische Auswirkungen auf die Richtlinien und die Strategien der Stadtplanung in der Metropolregion Bengaluru und darüber hinaus. Die rasche

und ungeplante Ausdehnung der Städte macht es erforderlich, nicht nur die Verwaltung von Gemeingütern in die Entwicklungspläne einzubeziehen, sondern auch die Rolle staatlicher und nichtstaatlicher Akteure. Diese Einbeziehung von Akteuren setzt voraus, dass der Staat die Beteiligung nichtstaatlicher Akteure an der Planung und Umsetzung von Aktivitäten zur Verwaltung von Gemeinschaftsressourcen in Betracht zieht und ermöglicht, indem er angemessene institutionelle Unterstützung bereitstellt. Darüber hinaus ist es notwendig, eine gemeinsame Problemdefinition zu entwickeln und die Ziele der Akteure bei der Bewirtschaftung von Gemeingütern wie Seen, die von Natur aus miteinander verbunden und nicht an Verwaltungsgrenzen gebunden sind, neu auszurichten, was zu einer ganzheitlichen Entwicklung führt.

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1. Chapter 1: Introduction

Cities and towns are the drivers of economic growth, accounting for nearly 80% of the global GDP (UN, 2023). A key driver of growth of cities is increased migration, resulting in rapid expansion, which is shaping city development and has influenced organisation and institutions which govern city spaces (both public spaces and common-pool resources) (UNHabitat, 2023). UN Statistics highlight that the physical infrastructure in cities has not advanced with population growth rates. Further, the implementation of modern urban planning and management practices has radically changed the role of public spaces for communities across urban areas (Mandeli, 2019), with a drastic reduction in quality and accessibility of common-pool resources to the residents. The New Urban Agenda of UN Habitat has highlighted the role of local action and engaging local communities and governments and creating new partnerships between actors as critical to building sustainable cities (UNHabitat, 2016).

1.1 Motivation and Gaps in Literature

We are in an era of rapid urbanisation, especially in the global south, where extraordinary growth of cities is proceeding at an unprecedented scale. Most drastic changes in terms of urbanisation are associated with rural-urban transformation involving extensive modification of land-use coupled with ecological degradation due to bio-physical changes leading changes in socio-economic and ecosystem services derived from resources (Nagendra & Ostrom, 2014; Seto et al., 2011). These challenges are further aggravated by a disjoint between institutions and the ecological dynamics, which is widening because of increased separation between humans and nature in cities (Colding et al., 2020; Folke, 2007). Urban transformation leads to changes in the biophysical structure, governance arrangements, roles, and values associated around lakes within the community (Enqvist, 2017; Mundoli et al., 2017; Enqvist et al., 2016), which has influenced community engagement and participation.

The trend of urbanisation is exerting pressure on the natural resources (Zhou et al., 2017) across the world. Unplanned urbanisation does not integrate local ecosystems and local needs of communities alienating people and their vital association with ecosystems (Folke et al., 2002). This affects the access to resources besides influencing ecosystem functions outside the boundaries and within the jurisdiction (Ramachandra et al., 2020). Policy decisions regarding urban growth are often top-down, devoid of either stakeholders' participation or consideration of ecosystems. These approaches have created imbalances within the existing ecosystem and the livelihood of communities, especially the vulnerable. Unprecedented increase in population

and the consequent demand for land, and unplanned policy interventions with fragmented governance are threatening the natural ecology of the area. The first to fall prey in the process of urbanisation are ecologically sensitive lands (such as agricultural land, forests, wetlands and water-bodies) (Yu et al., 2021) often termed as the commons.

Urban areas provide a multitude of ecosystem services, of which water is one of the most critical resources for survival of humans and waterbodies are most affected by urbanisation (Nagendra & Ostrom, 2014). Resources such as lakes, ponds and other water-bodies which are managed as common-pool resources in rural areas, have been transferred to state agencies in urban areas (Nagendra & Ostrom, 2014; D'Souza & Nagendra, 2011). These resources play a critical role in creating sustainable cities, as they provide community space for social integration (Mundoli et al., 2014), regulating local climate and reducing the impacts of climate change (especially floods). Common-pool resources are highly threatened due to pollution, degradation, encroachment and conversion as a result of unplanned and uncoordinated growth, inefficient resource utilisation including awareness of the resource and its importance. These are further endangered because of increased tendency of local governments to centralise their control over natural resources and ecosystems (Narain & Vij, 2016), especially as these spaces are being viewed as potential sources of investment and economic benefits (Friedmann, 2010). Governance and institutions play a key role in not just safeguarding these commons, but also to ensure adaptation to the challenges of water security in urban areas, yet these aspects have been little explored compared to technical solutions (Nagendra & Ostrom, 2014; Huang et al., 2010). Most studies of the commons have focussed on rural areas, with an increasing consideration of urban commons, and there is a lack of research examining the role of urbanisation in changing access and availability of commons (Mundoli et al., 2014). There has also been limited research assessing the (rural-urban) transformation of institutional regimes for managing commons (Narain & Nischal, 2007).

Urban governance literature is based on the underlying area that the notion of a city and the urban as a territorially bounded entity. This notion of urban as a quality of territorially defined city persists in everyday thinking and much of the scholarly literature, including a vast majority of research on urban commons. This understanding clearly helps us to comprehend the differences in experiences between spaces within and outside the city, mainly the peri-urban and the countryside. Today, urbanisation patterns also increasingly challenge the self-evident distinction between city and countryside, urban and rural spaces (Kip et al., 2015). This is mainly because of the process of urbanisation, where both megacities and their surrounding

rural spaces are linked to each other. Research in the peri-urban areas has shown that there is a mutual dependence between the surrounding areas and the urban centres (Narain & Nischal, 2007). It is usually the case where cities import resources, such as water and food, and export their waste and wastewater into these surrounding areas. This is in line with Lefebvre, for whom the urban condition has gone beyond the boundaries of the city and brings together distant spaces, events and people (Kip et al., 2015). Thus, urban can be considered as a set of processes that links places across space and is defined by connectivity (Huron, 2017; Kip et al., 2015).

Urban governance has seen a drastic shift in recent years, focusing on the increasing role of non-state actors (Minnery, 2007). There is a greater emphasis on the need for involvement of non-state actors when managing urban commons (Mikelsone et al., 2021). Thus, urban governance is seen to include not just the role of governments but also the private and community actors (Healey 2006). Thus, highlighting that urban governance consists of many centres of power, where the state is no longer supreme but is still a key player (Foster, 2011; Peters & Pierre, 1998). Thus, urban governance can be considered to be moving towards an arrangement of ‘governance beyond the state’ (Swyngedouw, 2005, p. 1991), leading to polycentric governance arrangements. Given the complexity of resources and stakeholders involved in urban governance, concepts of polycentric governance is highly applicable in understanding the governance of commons in urban areas (Meinzen-Dick et al., 2021). A polycentric system is defined to be a “self-organising system composed of many autonomous units formally independent of one another, choosing to act in ways that take others into consideration, and through processes of cooperation, competition, conflict and conflict resolution” (Stephan et al., 2019).

Based on the above understanding, I use the polycentric governance framework developed by (Baldwin et al., 2023; Thiel et al., 2019; Thiel & Moser, 2019; Thiel, 2017) to situate the three research questions as indicated in the Figure 1. My first research question (Paper1) focuses on the independent variables to understand how the changing rules and both in external institutional structures, the biophysical contexts and heterogeneity influences the distributional outcomes and power asymmetries of actors negotiating alternative institutional arrangement. The second and third research questions (Paper 2 and Paper 3) explore the newly negotiated institutional regime of co-management. Paper 2, explores the necessary and sufficient conditions which affect the structure of polycentricity whereas paper 3, focuses on the behaviours and roles of bridging actors in enabling co-management by developing a typology

for these actors using social network analysis to understand how lake management is influenced by social networks. Methodologically, this is approached from an interdisciplinary SES perspective, combining qualitative data, collected primarily through interviews and focus group discussions, and secondary literature.

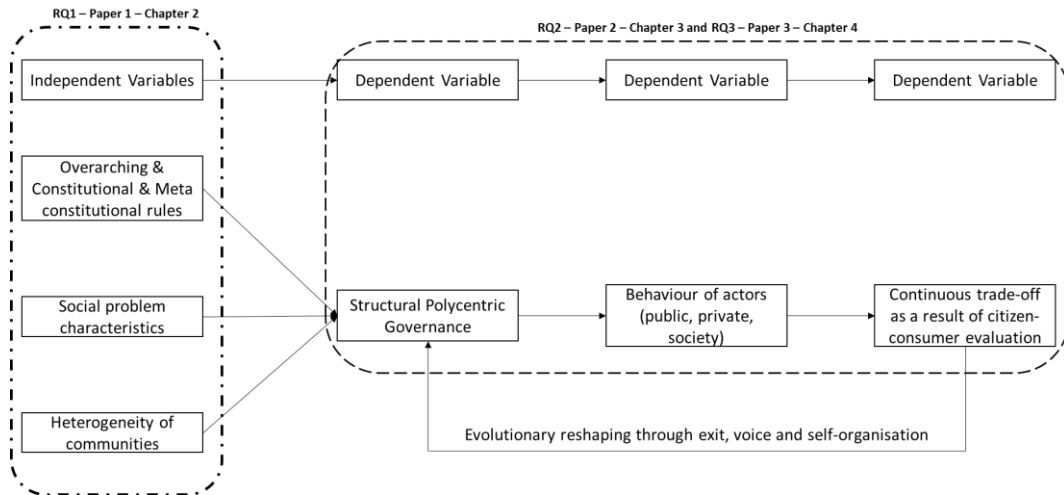


Figure 1: Situating the research questions within the Polycentric Governance Framework developed by Thiel (2017)

This dissertation critically investigates to understand how institutions around the governance of water-bodies changes with urban transformation. In line with our consideration of urban as a process, this dissertation focuses on how community engagement and participation around commons (water-bodies) evolve along a rural-urban transformation. A much more detailed literature review of each aspect is presented in the individual chapters. This dissertation seeks to contribute to interlinked aspects of the literature on institutional change, urban transformation, co-management, bridging actors, and polycentricity by contributing to the development of a mid-range theory of institutional change in areas under urban transformation. Further, the dissertation also contributes to enhancing the learnings of drivers influencing co-management and lastly adds to the literature on the role of bridging actors in enabling co-management of commons, mainly lakes.

1.2 Research Objectives

Based on the above motivation and the gaps in literature, the overall aim of this dissertation is to investigate and understand how institutions and governance change in the process of urban transformation. To understand this, the dissertation pursues three objectives: First, to understand how community engagement and participation has changed since the state takeover of public lands, including commons, in the 1960s. Second, to investigate how legitimacy of

participation, shared understanding, and resource exchange influence the co-management of lakes. Finally, to understand the role of bridging actors in formation and strengthening of collaborations among actors engaged in co-management of lakes.

1.3 Dissertation Structure and Design

The nature of the research objectives and questions identified for this dissertation have determined the research design, selection of the study-area, data collection methods and analysis, and the overall research approach. This has led to the structure of the dissertation into three different but related chapters, based on the comparative study of three lakes, along a spatial rural-urban gradient, within the Greater Bengaluru Metropolitan Region. The choice of the research objectives has led to the use of mixed methods approach, even though the major focus lies on qualitative data. The focus on the thesis is shaped by my interest in understanding the social and political process affecting lake management and their outcomes in areas of urban transformation. Qualitative research leads to understand the decision-making processes by analysing a broad range of variables by integrating diverse perspectives of individuals/groups involved in these processes (Creswell 2014). I use a mixed method approach for my third paper where I use social network analysis where the network was developed using the qualitative data generated through interviews and focus group discussions. This approach, though based on qualitative data, provides greater to explain complex phenomenon (de Vos et al., 2021).

Case Selection: the cases were selected based on a comparative case study method as indicated by Yin (2018) and Miles et al., (2014). The comparative study covers contrasting cases of three lakes along a spatial rural-urban gradient. This approach enables investigation of causal questions, such as how and why management of commons such as lakes has changed with urban transformation. Cases along a spatial gradient covering rural-urban areas within the Greater Bengaluru Metropolitan region, as this provided us with an area under ongoing urban transformation. This consideration of spatial gradient provided us with data of ongoing urban transformation, suitable for comparison of the cases. The use of spatial gradient aided us in our understanding of the ongoing relationships and interactions between actors (Agarwal, 2022; Jochner et al., 2013). The case selection was undertaken based on a desktop review of the population, literacy rate, main employment of the area, and access to amenities such as highways and roads using the Indian Census of 2011. After this, the survey stratification index (SSI) developed by Hoffmann et al., which classifies Urban, peri-urban, and rural based on the distance from the centre of the city and the built-up area versus open area. Once the selected areas were classified based on their spatial location. This was followed by an exploratory field

visit in 2018 to identify and finalise five cases from the identified initial 15 cases. The three cases were narrowed down to cover one case in urban, peri-urban, and rural areas. In this thesis, I use just three cases, each one located in urban – peri-urban – rural areas along a single watershed, providing a contrasting comparative case (lakes) located in areas with differing urban development (Refer Table1). The indicators of urban development were chosen based on the research objectives to ensure that this selection of contrasting cases helps us to understand how rapid urbanisation affects changes from a new institutionalism perspective, that is seldom addressed in literature on urban studies.

Table 1: Highlighting the Contrasting features of the cases across the urban-rural gradient

	Socio-economic Characteristics			Bio-physical Characteristics		
	Population Density	Literacy rate in %	Heterogeneity	Dependence on the lake for livelihood	Ecosystem Services derived	Water Quality
Rural	391.28	63.4	Low heterogeneity (mainly farmers)	High dependence as 70% of the population is dependent on the lake	Production related services	Treated wastewater from upstream urban and peri-urban area flow into the lake
Peri-urban	Average across 4 villages 516.43 (highest is 791 and lowest is 297)	Average across 4 villages 66.61 (highest is 72 and lowest is 60)	Medium heterogeneity (with floating population, working in the industrial area others are local farmers who more homogenous)	65% in three villages and 12% in the fourth village engaged in agriculture and allied activities	Production related services	Treated wastewater from upstream urban areas flow into the lake unchecked
Urban	6218	76.4	High heterogeneity (diverse linguistic and occupational resident groups)	Low dependence	Cultural and Recreational services	Rainfed and wastewater is deviated from the lake with an STP built around the lake

Dissertation structure: The dissertation is structured into three self-contained chapters of which Chapters 3 and 4 are published as part of the special issues on “co-production” and “urban development”. The dissertation is structured into three main chapters, based on the three research objectives. Each of the chapter covers literature review, conceptual framework, results and discussions separately in their respective chapters. Of these three chapters, the third chapter is published in “Environmental Management” and the fourth chapter is published in “Sustainability”.

The chapters of the dissertation are designed to have a flow from a broader change in institutions to more specific roles of actors in ensuring lake management during urban transformation. Chapter two builds on the framework developed by Thiel (2014) focusing on broader investigation of how changes in eco-institutional setting influence the implicit negotiations of new institutional equilibrium from the lens of New Institutional Economics. The comparative cases were selected to highlight diverse actors and changes in their distributional outcome and bargaining powers considering the conflicts arising from abundance of water (resource abundance) besides scepticism towards state management of lakes. To understand this, primary qualitative data was collected through key informant interviews and focus group discussions with state and non-state actors involved in managing the lake. The paper, following the conceptual framework of polycentric governance, develops a stylised action situation of how community engagement and participation changed since the state took over of common property resources in the 1960s. The main findings highlight that the changes in the biophysical conditions have led to changes in the distributional outcomes of the actors involved in lake management. There has been an increase in the heterogeneity and overlapping administrative jurisdictions with urban transformation, increasing scepticisms and transaction costs of negotiations. In the urban areas, previous experience and motivation of the community has led state actors working with local communities through third-sector organisations leading to negotiations of new institutional arrangements. The same is also seen in the rural case, where the community, because of its high dependence on the lake, works with state agencies to overcome scepticism and negotiate a new institutional arrangement of co-management. The same, however, is not true in the peri-urban lake, where increasing heterogeneity, overlapping institutions and complex administrative jurisdictions have led to lack of interactions among actors increasing scepticism and transaction costs for negotiating a new institutional arrangement.

Chapter three of the dissertation develops on the findings of the previous chapter, where we identify actors involved in lake management have negotiated a new institutional regime of co-management to manage lakes. The chapter focuses on understanding how pre-conditions of legitimacy, shared understanding and resource exchange facilitate co-management of lakes. The chapter draws from the discipline of co-management and co-production and is based on a qualitative analysis of actors involved in the selected lake management across a rural-urban gradient. I use primary qualitative data collected through key informant interviews and focus group discussion of both state and non-state actors. The chapter highlights the prominence of socio-economic heterogeneity which influence community involvement for co-management. It is found that none of the three pre-conditions are individually sufficient but are necessary conditions for facilitating co-management. The chapter highlights that with urban development, state actors have realised the efficacy of involving non-state actors, but mainly for securing information and financial resources for lake management. We find that third-sector organisations play a prominent role as bridging actor by developing a shared understanding to organise a heterogenous community and facilitate institutional building across the rural-urban gradient.

Chapter four of the dissertation takes the findings of Chapter three further by focusing on the role of these bridging actors in ensuring co-management of lakes along the spatial gradient. In this chapter, we develop and apply a framework based on the characteristics of bridging actors, initiation of the bridging actors, their position, and role in facilitation. The role of bridging actors is analysed using social network analysis based on qualitative data collected through key informant interviews and focus group discussions. The Chapter identifies state sponsorship is crucial in initiating bridging actors in urban and peri-urban cases due to heterogeneity. Further, it was found that the position of bridging actors is important in facilitation of interaction by promoting innovation through information exchange. Finally, looking at the network maps and parameters using social network analysis it is clearly identified that the network is disconnected based on administrative boundaries along the selected spatial gradient leading to problems of institutional fit between the social (actors) and the ecological (lake) systems.

Chapter five provides an overarching discussion of the findings and how they connect with each other, articulating overall conclusions and some policy recommendations. Finally, I discuss the study limitations and gaps that may direct future research.

2. Chapter 2: Negotiating a change: How communities are negotiating a space for themselves to manage urban commons

Abstract

Urban transformation has had a profound impact on ecosystems and commons, not just within defined city boundaries but across surrounding regions. Urbanisation increases heterogeneity, which may lead to changes in social values and institutional arrangements for managing commons such as lakes. In this paper, we describe how changes in eco-institutional settings influence institutional change along a spatial (rural-urban) gradient within a single watershed in the Metropolitan region of Bengaluru. We conceptualise how changes in biophysical characteristics, values and services derived associated around lakes change the distributional outcomes of actors leading to negotiations of new institutional arrangements for lake management. To understand how actors negotiate a new arrangement, we focus on four first-tier variables of mental models, governance technologies, interrelated institutions, and transaction costs. We find that with urbanisation there is an increasing heterogeneity of the community, the role of state actors is greater in more urbanised areas to ensure negotiation of new institutional arrangement. In the peri-urban areas, there is a failure to cooperate among actors because of the multiplicity of state actors and a disjoint and heterogeneous community which is sceptical of engagement. Whereas in rural areas, the role of communities is crucial to governance and overcoming state scepticism and negotiate a new institutional arrangement.

Keywords: Institutional Change; Urban Commons; Urban Transformation; Lakes; Urban-Rural

2.1 Introduction

Urbanisation includes the growth and reorganisation of social life, which is an ongoing feature of capitalism affecting both cities and countryside in equal measure (Mossberger and Stoker 2001; Kantor et al. 1997). Lefebvre (2003) argues that urbanisation is both form and process as it includes transformation of identity, disposition, psychology, culture, and lifestyle. Huang et al. (2010) highlight that urbanisation not only influences the socio-economic characteristics but also leads to large scale ecological transformation, which affects the functioning of both global and local ecosystems and the services derived.

Urbanisation has been a key demographic trend in India in the past and the current century (Mundoli et al. 2015). Several Indian cities have been on the trajectory of steady growth,

sustained by a boom in real estate and rapid growth of outsourcing and other services (Narain and Singh 2017; Vij and Narain 2016). This can be attributed to the favourable environment created by the liberal reforms in 1991, where private sector mainly the service industry, real estate and outsourcing services, expand the scale of their operations (Dupont and Sridharan 2006; Vij et al. 2018). Urban transformation is driving large-scale modifications of ecosystems, where urban land use strongly limits the availability of places and where people can access nature and its services (D'Souza and Nagendra, 2011). These modifications promote urban inequality and inequity because of disproportionate appropriation of ecosystems, which can be associated with urban heterogeneity (Balakrishnan, 2016). Heterogeneity can be seen to vary not just across socio-economic characteristics, but also across the biophysical characteristics, social motives, moral frameworks (Saha, 2021), and the valuation of ecosystem services derived.

Cities in Southern Asia, especially India, provide an important context for studying the consequences of urbanisation, as they are undergoing massive unplanned expansion and migration leading to control of a significant share of the economy (Shaban et al. 2020). These cities impact the ecosystems not just within their boundaries, but also influence the “dynamics of the region” (Saha, 2021). This creates additional challenges by increasing imbalances in equity, socio-economic and socio-ecological systems (Luna et al. 2014). In the Indian context, Vij et al. (2018) highlight that the changing urban landscape produces a diversity of institutional responses ranging along a continuum from cooperation to conflict of interests, which are poorly studied in an urbanising context. There has been limited research to understand if this diversity of institutional responses are resultants of scarcity of resources or their mismanagement (Vij et al. 2018; Luna et al. 2014). Hence, there is a critical need to focus not just the transformation of institutional and governance structures in urbanising contexts but also the functional patterns of institutional structures as indicated by Riggs (2006).

There are numerous theories to explain how institutions change. These include New Institutional Economics, where institutions are argued solve collective action problems efficiently, leading to an establishment of institutional structures, which meet the needs of all actors. This change is achieved under the preconditions of low discount rates, low transaction and information costs and shared norms. In the theory of punctuated equilibrium, institutional change results from exogenous shifts such as change in people's perceptions or in governing coalitions which disturb stability, pushing for negotiations of a new equilibrium. Further, the theory of gradual change in historical institutionalism is based on the premise that institutions

are based on how they are interpreted and enacted and therefore subject to different interpretations. Consequently, this results to contradictory interpretations and promotes the need for change. The existence of power differentials among actors makes this interpretation fraught with tension, leading to formations of coalitions, which work within their own bias (Alexis, 2018).

In our cases along the urban-rural spatial gradient in the greater Bengaluru metropolitan region, we see that urban transformation and changes in exogenous formal institution, have influenced actor choices, values and informal institutions associated with lake management. To understand this change, we use the distributional theory of institutional change, which is helpful to focus on the gradual changes in power asymmetries and/or distributional consequences of actors involved in lake management.

We aim to understand gradual, informal institutional change in lake management because of urban transformation by comparing three lakes along a rural-urban gradient within a single watershed for a time-period 1960-2018 in the Greater Bengaluru metropolitan region (GBMR). To understand institutional change, we develop a stylised action situation (AS) of community engagement and participation. This helps us in focusing on our research question, how urban transformation has gradually influenced power asymmetries and differential outcomes of the actors leading to the negotiation of new institutional arrangements of lake management. Drawing on the analytical framework developed in Thiel 2014, we try to answer our research question by understanding how changes in the eco-institutional setting affect changes in distributional outcomes resulting in diverse institutional responses in lake management along a spatial gradient between 1960 - 2018.

2.2 Framework

The conception of institutional change we employ in this paper builds on theories of institutional change rooted in New Institutional Economics (North, 1993; Lin, 1989; Knight, 1992) in the way it was operationalised for social-ecological systems by Ostrom (2005), Hagedorn et al. (2002), Hagedorn (2008) and Thiel (2014). This approach conceptualized the role of institutions by focusing on the interrelations between property rights that ascribe rights and duties to particular goods and services emerging from social-ecological systems, and governance structures that organize the way we call nature-related transactions between different actor groups, which may be individual (groups of) users or state actors that act upon at least formal legitimization by the public. In this account we use the conception of nature-

related transactions proposed by Thiel 2014, which has been defined as “interrelated changes in the utility of two actors that are mediated by non-humans, biophysical system that are subjected to intentional action by at least one actor” (Thiel et al. 2012; Thiel 2014).

Our approach is focused on understanding how changes in eco-institutional setting, described to apportion values from services derived from ecosystem among users and governing actors, leads to negotiation of alternative institutional arrangements. This approach hypothesises that actor’s evaluation of perceived costs and benefits of the diverse institutional alternatives leads to negotiations of new institutions. In this study, we seek to contribute to our understanding of institutional change due to urbanization, especially in management of lakes. We use the distributional theory of institutional change to understand how changes in institutions influence the choice of actors because of gradual change in power asymmetries and/or distributional consequences. Knight 1992, highlight that power asymmetries and distributional consequences incentivize both, intentional and spontaneous change of informal rules (Kasymov and Thiel 2019 p 932). Thus, we use the distributional theory to understand the change in institutions and their implications for lake management.

Drawing from the distributional theory, we understand institutional change to be a process where differentially resourceful actors negotiate a change based on their interests (Theesfeld 2005; Kasymov and Thiel 2019). Institutions affect the payoffs of actors by providing information, which aids actors in planning their actions, leading to shared outcomes. Knight (1992) describes institutions as stabilized outcomes of negotiations between actors. Institutions help to realise the benefits of cooperation. However, as Knight (1992) writes, the design and change of institutions can be intended and or unintended outcomes of actors’ negotiations over the distribution of outcomes from cooperation. We also follow the broad ideas of Knight’s distributional theory when we conceptualize why and how institutions in the eco-institutional setting change. Applied to our context, for Knight, institutions are the outcomes of negotiations about how to order and institutionalize nature-related transactions. They express an equilibrium of the strategic interests/perceived benefits that actors expect from alternative outcomes of negotiations and their capacities (power resources) to attain these benefits, whereby power is conceptualized as capacity of actors to survive rounds of negotiations/periods of time without cooperating, that way also withholding benefits from interdependent actors. We argue that this negotiation setting can be appropriately conceptualized by what Ostrom calls an action situation (AS), i.e., a situation where actors’ benefits interdepend and where they are negotiated under set rules and in a strategic manner (Ostrom 2005). If institutions express stability in the

action or negotiation situation, institutional change expresses change in this situation and its contextual determinants. Thus, the variables in the categories singled out in the eco-institutional setting, such as biophysical and exogenous institutional structures, play an important role in ascribing the values and functions ascribed to services derived (de Groot et al., 2010; Haines-Young and Potschin, 2010), and need to somehow change in order to trigger institutional change and the emergence of a new institution and equilibrium.

Knight focuses on the power relationships between actors involved in bargaining over institutions and defines power as "... the ability to affect one's feasible set [of choices]" (Knight 1992: 41). How long an actor wants to withstand cooperation, given unfavourable outcomes, depends on the relative bargaining power (determining payoffs of non-cooperation) and on distributional outcomes (determining payoffs for cooperation). The decision to cooperate or not is central to Knight's institutional analysis of basic social interaction among actors. Knight, in his conceptualization of a bargaining interaction, uses the bargaining mode developed by Rubinstein (1982) that is represented by the following situation and question as stated in Kasymov and Thiel (2019:933) "two individuals have before them several possible contractual agreements. Both have interests in reaching an agreement, but their interests are not entirely identical. What will be the agreed institution, assuming that both parties behave rationally?"

In what follows, we develop a heuristic of factors that influence distributional outcomes leading to cooperation as an outcome and bargaining power, an increase of which leads to failure to cooperate among actors, thus leading to institutional change as perceived by the distributional theory of institutional change. This builds on the heuristic of factors driving institutional change put forward by North (1994), that singles out changes in mental models, interrelated institutions, transaction costs, technologies of governance as drivers of institutional change and puts these into a context of path dependence accounting for the costs of changing institutions. The heuristic presented below, and the examples provided, are far from conclusive as regards what shapes distributional outcomes and bargaining power. The factors singled out are contextual to the extent they emerge from developments beyond the specific object of institutional change. They may change the valuation of institutional alternatives and associated payoffs as such or affect the negotiation processes to attain a particular institutional option. From the perspective of Ostrom's action situation, where negotiations over alternative institutions occur, they may affect the community attributes, the biophysical characteristics, or the rules that structure an action situation. As shown in Figure 2, the biophysical characteristics

include changes in the ecosystem services derived. We look at ecosystem services as defined by IPBES framework, which speaks of “Nature’s benefits to people¹”, which comprises all the ecosystem services inclusive of provisioning, regulating and cultural services (Diaz et al. 2015). Diaz et al. (2015) show that most of nature’s benefits are co-produced with contributions from both nature and anthropogenic assets and drivers, which are influenced by institutions and governance structures. These components are classified as “Eco-institutional setting” by Thiel 2014, who consider the role of socio-ecological and economic values, which are considered to motivate actions by actors. The actions by actors are driven by institutional and governance structures, where we comprehend institutions as de facto rules that describe how actors interact in certain situations (Thiel 2014). These institutions include shared strategies, norms and rules determined by the sanctioning mechanism (Thiel 2014). As highlighted in Thiel 2014, governance structure shows the “*changes in actor networks engaged in governance*” which influence nature’s benefit to people. When interpreted as transaction costs, this indicate the “*interrelated changes in the utility of two actors that are mediated by non-human, biophysical systems that are subjected to intentional action by at least one actor*” (Thiel et al. 2012; Thiel 2014).

As one category of the heuristic driving institutional change, we want to highlight the interrelated changes in the valuation of alternative outcomes and (institutional) instruments to attain them because of **changes in mental models**. We consider this a first-tier category of variables shaping institutional change. Following North 1992 and Ostrom 2005, we argue valuations are affected by mental models, which may become ideologies or paradigms when they are shared among actors. They describe an idealized institutional and governance configuration or outcomes of institutional configurations that actors perceive to be in their interest and that correspondingly affect the valuation of institutional alternatives. For example, the paradigm of River Basin Management long affected the valuation of institutional alternatives for water management by actors. Changes in actors’ identities, mental models and paradigms change the valuation of institutional options and associated outcomes that way incentivizing institutional change. Over time, this may change negotiations over institutions and their outcome. The transaction costs of *negotiations* themselves may, for example, be

¹ The conceptual framework considers all ecosystem goods and services such as provisioning, regulating and cultural services as defined by the Millennium Ecosystem Assessment Reports under Nature’s benefits to people.

affected positively when certain values and mental models over time become shared by a larger part of actors negotiating institutions.

Further, we want to single out **changes in governance technologies** as further first tier factor driving institutional change that affects the costs of maintaining a particular institutional order. For example, technologies that lower costs of tracking and sanctioning agents' behaviour may make specific institutional options more cost effective and attractive over time, disturbing an eco-institutional equilibrium. Similarly, changes in governance technologies such as technology to share information and exchange may change the costs of *negotiations* over institutional alternatives, that way making a shift from one institutional equilibrium to another one more attractive as costs of renegotiation and consolidating a position on an alternative institutional option may decrease. If such costs increased however, renegotiation was unlikely.

Another category of variables at the first tier that may affect eco-institutional equilibria and institutional options and institutions structuring negotiations are **interrelated institutions**. This category relates to the fact that institutions are nested in institutions at the collective choice and constitutional level, as well as they are interrelated with institutions regulating interdependent issues (Ostrom 2005). Thus, changes in such interrelated institutions may change the institutional equilibrium under investigation in multiple ways. First, it may change the transaction costs of institutional and governance options. For example, when collective water management is introduced as mandatory, this may provide for economies of scale and scope in relation to collective action relating to further goods and services and natural resources that way increasing net benefits of such a regime. Similarly, when a cadaster was introduced in a region, registering formal land titles, this usually eases market governance of land transactions, which may lead to changes in corresponding governance arrangements of land transactions. Thus, changes in interrelated institutions may change the net benefits of institutional options and transitioning towards them, changing what Ostrom called payoff rules. Alternatively, beyond effects on net benefits of preferred institutional options, changes in interrelated institutions may allow specific actors to act strategically throughout *negotiations* in interdependent action situations and using what are also called issue linkages. In those cases, interrelated institutions may lead to side-payments favouring certain behaviours, or to a subtraction of payments of interdependent actors in interrelated action situations. Elsewhere, we also called this positional power of actors catered to by interrelated institutions (Thiel 2014).

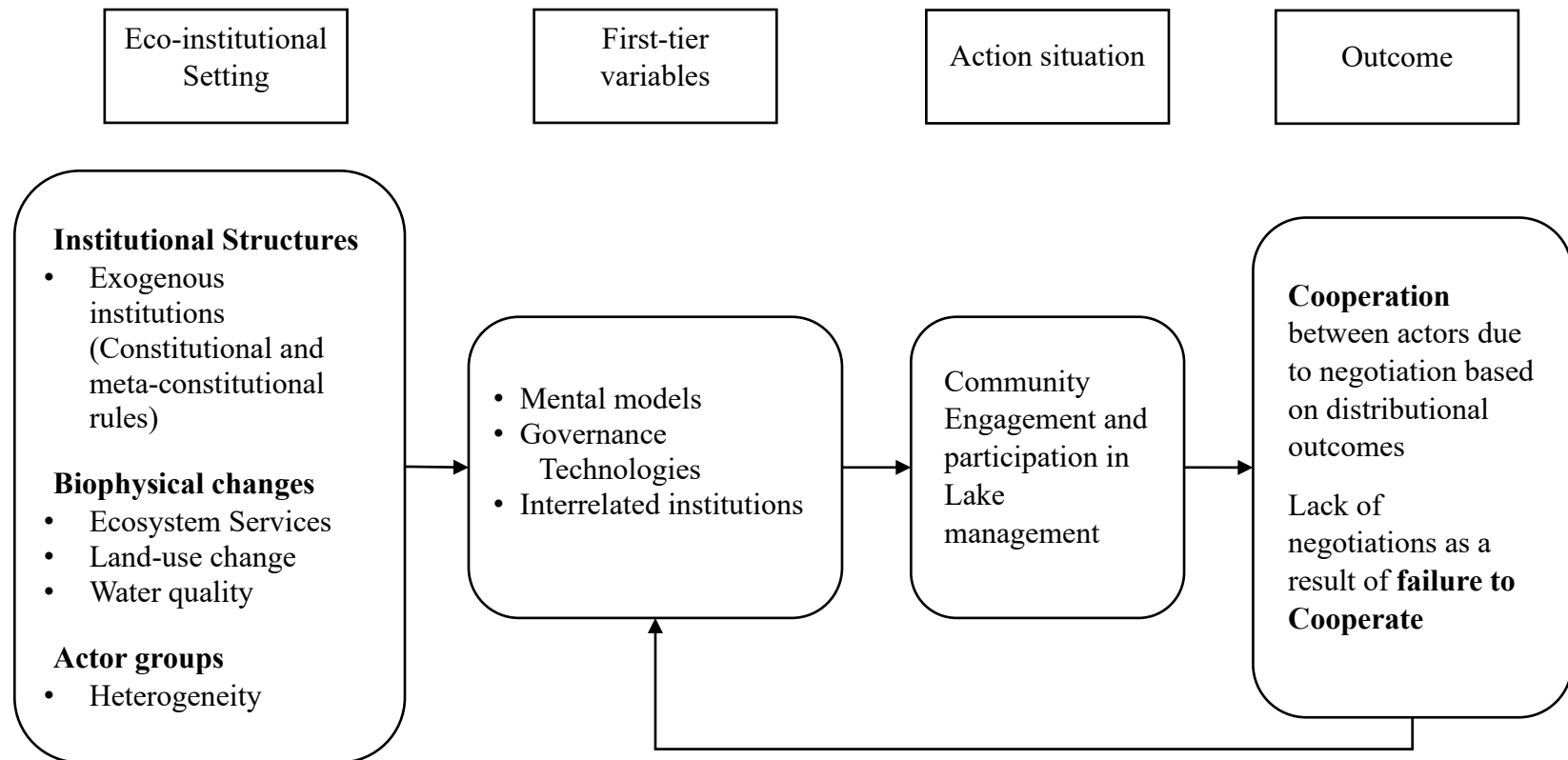


Figure 2: A heuristic framework for institutional change listing first tier variables for the stylized action situation of community engagement and participation in lake management

2.3 Case study selection and methodology

Bengaluru, the third largest city of India with over 10 million residents, located in the Southern Indian state of Karnataka has grown more than 10 times since Independence in 1947 from 69 sq. kilometres to 741 sq. kilometres in 2007 providing a characteristic example of rapid urban expansion at the expense of natural ecosystems (Nagendra and Ostrom 2014). The Greater Bengaluru Metropolitan Region (GBMR) covers an area of 8005 sq. kilometres and comprises three administrative districts. The region located in the rain shadow areas of the Deccan hills, the area has been dependent on natural and human made lakes to fulfil its water needs (Enqvist et al. 2016; Nagendra 2016). The undulating topography of the region supports small streams which have been dammed to form a series of freshwater reservoirs or tanks (henceforth referred to as lakes) varying in size and use from provision of drinking water, fishing and irrigation, besides as spaces of social and cultural importance (Mundoli et al. 2018; Mundoli et al. 2015). The local communities using the lakes were responsible for its maintenance, including repairs, desilting of lakebeds, ensuring the catchment areas were free of encroachment (Enqvist et al. 2016).

Establishment of information technology hubs post liberalization of Indian economy (1991) resulted in an exponential increase in population and rapid growth creating an urban sprawl (Verma et al. 2017), with an increase in urban population from 44.4% in 1901 to 90.9% in 2011 (Puttalingaiah et al. 2019). The rate of urbanisation has posed a serious challenge to urban planners, leaving a lasting impact on lakes, which began losing its defining characteristics mainly because of blockage or destruction of water channels leading to drying of lakes which were encroached. Urban transformation in Bengaluru has led to changes in the biophysical structure, governance arrangements, roles and values associated with lakes within the community (Murphy et al. 2019; Enqvist et al. 2016; Mundoli et al. 2015), which has influenced community engagement and participation for lake management.

Thus, in this paper, we look at community engagement as our stylised action situation (AS), in our pursuit to understand how community engagement has changed with urbanisation (between 1960-2018).

2.3.1 Materials and Methods

In this paper, we use a contrasting case study design (Yin 2018; Miles et al. 2014). We select three contrasting cases, which are embedded within a single watershed (Vrishabavathi) along a spatial gradient (urban-rural) in Southwestern Bengaluru. This case design provides us an

opportunity to compare cases across a rural-urban gradient analysing how urbanisation affects community participation in lake management at the local level in GBMR. The watershed is characterised by the inflow of wastewater from upstream urban areas, promoting continued agricultural practices in downstream peri-urban and rural areas. The cases (lakes) were identified based on their geographic location along a spatial gradient following the survey stratification index developed by Hoffmann et al. (2017)², the administrative boundaries, livelihoods, and ecosystem services drawn by residents. There was a difference in the ecosystem services drawn along the gradient, with urban residents drawing cultural services, whereas in rural areas the lake is looked upon for its provisioning of water for irrigation and as a cultural space. In the peri-urban case, we cover four villages located along the lake boundaries, of which three villages are dependent on the lake for irrigation, whereas the fourth village has recently been amalgamated with a nearby town administration. This is due to the presence of an industrial estate leading to transformation to a non-agrarian livelihood of the community, thus drawing multiple services from the lake. This provides an opportunity to study the transformation in values along a single watershed with varying stages of urbanisation. The contrasting features, including heterogeneity of socio-economic, cultural, linguistic, and occupational diversity captured during interviews and observations across the three cases, are listed in the Table 2.

Table 2: Socio-economic and Biophysical characteristics of the cases across a rural-urban gradient

	Socio-economic Characteristics			Bio-physical Characteristics		
	Population Density	Literacy rate in %	Heterogeneity	Dependence on the lake for livelihood	Ecosystem Services derived	Water Quality
Rural	391.28	63.4	Low heterogeneity (mainly farmers)	High dependence	Production related services	Treated wastewater from upstream urban and peri-urban area flow into the lake

²Survey Stratification Index by Hoffmann et al 2017, classify urban-rural areas based on the proportion of built-up areas around defined settlements and distance from the city centre

Peri-urban	Avg across 4 villages 516.43 (highest is 791 and lowest is 297)	Avg across 4 villages 66.61 (highest is 72 and lowest is 60)	Medium heterogeneity (with floating population, working in the industrial area others are local farmers who more homogenous)	Mixed across the villages	Production related services	Treated wastewater from upstream urban areas flow into the lake unchecked
Urban	6218	76.4	High heterogeneity (diverse linguistic and occupational resident groups)	Low dependence	Recreational services	Rainfed and wastewater is deviated from the lake with an STP built around the lake

Our case lakes are located along the Vrishabhavathi River, where the actors directly involved in their management were identified following the classification by Nabatchi et al. 2017, into state and non-state actors. State actors were identified to be those actors who were directly engaged in an activity, which was related to the state or supported by the state. The non-state actors were identified to be “members of a geographical community” who are directly involved in active participation in lake management and were beneficiaries of state actions. State actors were identified through document analysis and policies, focusing on who was responsible for lakes. Since many state organisations are responsible for lake management, we focus only on the State Custodians who are directly involved in day-to-day activities of lake management. Non-state actors were identified through scanning of social media platforms, media articles and visits to the lake, followed by snowball sampling of key informants. Non-state actors directly involved in lake management were narrowed down to community (direct users) and third-sector agencies (NGOs in the case of urban lake) involved in lake management.

The community members, mainly farmers, were identified through key-informants, and were invited to focus-group discussions. The discussants were divided into groups comprising 10 members based on age groups. One group consisted of farmers over 50 years and another

consisted participants less than 50 years. In the peri-urban case, Focus Group Discussions were (FGD) conducted in all four villages, to acquire a holistic idea of the lake. 10 Focus Group Discussions with community members and 7 Semi-Structured Interviews (SSI) with government representatives and elected officials of the selected villages in rural and peri-urban case. In the urban case, we could only undertake three SSIs with representatives of the state agency, the third-sector organisation and the community-based organisation involved in managing the lake. Further SSIs were conducted with researchers/academics/lake-groups and NGOs involved in lake management in Bangalore to capture the general understanding of how lake management has changed in the region since 1960s. Interview times varied between 30 minutes to 2 hours, and nearly everyone agreed to the use of a voice recorder, except with certain government officials. The interviews and discussions were audio recorded, transcribed and analysed using Nvivo under the variables changes in management practices, organising the community, information flow among stakeholders, costs and benefits towards lake management as perceived.

2.4 Results and Discussions

In this results section, we focus on understanding how the stylised action situation (AS) of ‘community engagement and participation in lake management’ has changed since 1960-2018 across a spatial (rural-urban) gradient. We first describe changes in formal institutional structures between 1960-2018, which have influenced all three cases along the urban-rural gradient. This is followed by describing changes in the bio-physical, socio-ecological systems and actor groups, which are lake specific and are described individually in section 4.2. Table 1 summarizes the eco-institutional setting, which is also the rationale for choosing the cases. This is followed by a discussion on how urbanisation has led to changes in the eco-institutional setting and, thus, changes in power asymmetries leading to negotiation of new institutions for community engagement across cases individually and then across the spatial gradient.

2.4.1 Institutional contexts of lake management

We first describe changes in formal institutional structures between 1960–2018, which have affected the operational level rules of the lake.

2.4.1.1 Alienation of local communities from lake management

Water governance in India falls under the prerogative of individual state governments, who are responsible for drafting rules and regulations for governing and management of water and water-bodies. After India’s independence, the state of Karnataka was formally recognised in 1956, and the following decade of 1960s plays an important role in water governance due to numerous

changes in formal institutions in relation to lakes and land governance. The newly formed state legislature passed resolutions such as the Karnataka village offices abolition act in 1961, which abolished all the traditional offices responsible for managing issues relating to the village, including lakes. The Karnataka land revenues act implemented in 1964, declared all land, which was not owned by anyone, to become state property. Thus, commons such as lakes were now considered state property. These two major reforms led to alienation of local communities, as lakes were maintained by the local communities as common property resources and governed by village offices, which were headed and comprised by the community members.

2.4.1.2 Multiplicity of state agencies and neglect of lakes

With the establishment of state control on lakes in 1964, an additional number of government departments (fisheries, irrigation, forest, lake development authority, pollution control board) became involved in lake management based on the extent and role of lakes (Nagendra 2016). For example, fishing rights in the lakes were managed by the fisheries department, whereas water for irrigation was under the jurisdiction of the irrigation department, and the pollution control board is responsible for measuring the levels of pollutants in these lakes and henceforth. In urban areas the city development agencies were designated as custodians of lakes, whereas in rural areas, the public works department, and the local administration (Village panchayat, Zilla Panchayat, introduced in 1987) were made responsible for lakes with grants made available by governments. Over the following years, the lakes were mostly neglected due to lack of funds for actual repairs and lack of specific norms, or the nature of repairs to be undertaken. Most spending went to salaries of the staff and very little to maintenance (Nagendra 2016).

2.4.1.3 Urbanisation and lakes within the city

Starting in 1991, the Indian economy was liberalised, leading to a boom in the IT and service industry in and around Bengaluru, due to availability of land and tapping into the human resources leading to rapid growth and unplanned expansion of the city. In view of the rapid growth of the city leading to a change in the land use and destruction of lakes, the Government of Karnataka in 1985 constituted a committee to provide recommendations for protection and preservation of lakes in the then Bengaluru Metropolitan Area. The Karnataka forest department acting on the recommendations by the committee, undertook lake restoration and protection by constituting lake protection committees involving citizens living around the lakes (Dikshit et al. 1993). This was augmented by the 73rd and 74th amendment of the constitution of India in 1992, promoting citizen inclusion and active participation in management of natural resources as

against the conventional idea that the state is the sole responsible for natural resource management.

Despite these efforts, lakes were under constant threat and deteriorating with urban development. The state government in the year 2002, established the lake development authority (LDA) as an autonomous, regulatory, and policy planning organisation with an aim for protection, conservation, reclamation, restoration, regeneration and integrated development of lakes under its jurisdiction (The Hindu 4/25/2013). Due to lack of resources, the LDA started leasing lakes to private companies through public-private partnerships, which was challenged by non-governmental organisations leading to a judicial recourse by citizen groups and NGOs (Saldanha et al. 2012). This led to a series of public interest litigations by concerned citizens, leading to judicial intervention through establishing the Justice Patil Committee (2010). The committee recommended the state government to establish a focal agency to conserve lakes in urban areas and emphasised on the need to involve NGOs and local citizens in ensuring holistic lake management.

The state government, in 2014, established the Karnataka Lake Conservation and Development Authority (KLCDA) amalgamating LDA. KLCDA was empowered with statutory (powers to enforce) authority on all lakes within Municipal corporations and Bengaluru Development Authority under its jurisdiction and Karnataka Tank Conservation and Development Authority (KTCDA) for all lakes which were not under the KLCDA. In the year 2018, the state government without consultation and discussion with non-state actors passed a bill in the state assembly to disband KLCDA and handover control of all lakes irrespective of their geographical location within the state to the Karnataka Tank Conservation and Development Authority. There were protests by concerned citizenry in Bangalore against this move, which led to a lot of confusion regarding lake management, and we do not consider this last change in the shift of authority and stop our analysis of change in 2018. Though the citizenry has accepted this change, there was still confusion and information gaps regarding the responsible authority for lakes during our data collection, which was undertaken between September 2018 to March 2019.

2.4.2 Lake specific contexts and changes

In this section, we introduce the selected case study lakes along the rural-urban gradient, where the community has been alienated and is not engaged in lake management. We start by providing an overview of the changes in the bio-physical system, followed by identifying the main actor groups. This is followed by identifying changes in actor power relationships and/or distributional

outcomes, which has led to negotiation of new outcomes regarding community engagement and participation. Based on our understanding of Knights’ distributional theory of change, we can identify the options for main actors (state custodian and the community) involved lake management, as depicted in Figure 3.

		Actor 1: State Custodian	
	Available Options	Engagement	No Engagement
Actor 2: Community	Engagement	Cooperation	State scepticism towards the community
	No Engagement	Community scepticism towards the state	Non-cooperation

Figure 3: The probable contractual agreements between the main actors involved in lake management along the rural-urban gradient

2.4.2.1 Urban Lake

Biophysical changes: Uttarahalli moggekere lake, located in one of the densely populated areas of the city, was created in 1869 as a source of irrigation (Centre for lake conservation EMPRI 2018). The area around the lake has seen tremendous changes in land-use specifically between 2001–2018, where the census of India shows a decadal population growth of 161.9% and a household growth of 176.3% (GoI, 2011). This increase has led to conversion of agricultural land and a reduction of the catchment area of the lake. The lake area was fenced in 1993-94 and fell into despair due to disuse. Though the lake was in disuse, fencing the lake saved it from encroachment. The city municipal corporation (state custodian, BBMP) restored the lake in 2009, under its lake rejuvenations program by constructing a sewage treatment plant and diverting the inflow of wastewater out of the lake by circumventing the lake area thus, preventing the inflow of wastewater into the lake.

Actors: The main actors involved in lake management were the BBMP and a heterogeneous local community. This heterogeneity stemmed with inflow of new residents with urban development and the difference in valuation of the lake. The new residents who moved in with urban development and were unaware of the lake and its local ecosystem. The older residents, who had seen the lake fall into despair and disuse and fencing of the lake and were sceptical about state management of the lake. Another important actor is the third-sector organisation

(UwB), brought in by BBMP to create public awareness and secure financial support through CSR and finally the community association (UMNV), set-up by the UwB to undertake the day-to-day activities of lake management.

Changes in Ecosystem services: there has been a drastic change in the services derived from the lake, which was once a source of irrigation (production) in the area. These changes in services are resultant of urban development, which has brought in new users, with users deriving social and cultural services rather than the former production-based services by the once rural community. All actors, including community members and state custodian now value the lake as a space for social activities. The fencing of the lake in the nineties prevented the community from accessing the lake, thus reducing the community dependence on the lake.

Negotiation of new institutional arrangement: the state custodian could negotiate a new institutional arrangement to ensure community engagement in lake management by overcoming community scepticism towards the state by collaborating with UwB. The state custodian was open to working with the community due to previous engagements in different parts of the city with various other community groups.

The state custodian was able to negotiate a collaboration between itself and UwB due to changes in the interrelated institutions. This was made possible, as the state custodian accepted that they alone could not manage all the lakes in the city. Previous positive experience of working with community associations and NGOs on lake management had led to the development of tri-partite agreements. These agreements list out the roles and responsibilities of each signatory and plays an important part in engaging with other actors. The agreement provides the communities the legitimacy to act as well as improves their positional power, ensuring distributional outcomes in terms of engagement. This, coupled with exogenous changes pushing for involvement of local actors by the 73rd and 74th amendment of the Constitution of India, led to their collaboration. The Potential benefits of collaboration for the state custodian with UwB (third-sector organisation) are based on UwB's organisational aim of conserving the environment and building a just society by involving the local community.

The collaboration with UwB helped the state custodian to bring in an intended change in the mental models of the community by overcoming scepticism. The older residents were sceptical of the state custodian as they had seen the lake fall into despair and alienated from it with the fencing of the lake. This was highlighted during interviews with members "*cowherds who used the area for grazing were not allowed to graze... youth could not swim in the lake as well.*"

The new residents, who settled post 2000, were unaware of the lake and considered the lake area as a black spot of the locality and residents stayed away from the lake. Further, the new residents were highly heterogeneous comprising diverse socio-economic backgrounds as indicated by a member of UwB “*the residents in this locality come from different socio-economic groups, mixed community working in IT sector, government officials moving in from different parts of the country and state and spoke different languages.*” Thus, UwB had to organise a disjoint and heterogeneous community and overcome scepticism towards the state custodian and engage in lake management. This was achieved by working with local leaders, including elected representatives and prominent members of the community. UwB organised events and spread awareness through information dissemination among the community. As a non-governmental organisation, they sourced funding under the corporate social responsibility to undertake cleaning and desilting of the lakebed and organise tree plantation and other events capturing community attention and interest and finally after two years were able to organise the community based on a shared understanding into an association UMNv, which was made a signatory to a tri-partite agreement between the state custodian–community–NGO. Thus, changing the mental model of the community from being sceptical towards the state custodian to partnering and engaging with them increased the distributional outcomes for the community and the state to cooperate for matters of lake management.

The most important change in governance technology was the fencing of the lake by the forest department in the nineties. Though fencing conserved the lake area, it led to changes in community mental models and values associated with the lake. The community was further alienated and lost any form of values attached with the lake. This further increased the scepticism among the community towards the state and their management of the lake. The second most important change in governance technology was restoration (building of bunds, diverting entry of wastewater, constructing an STP) of the lake by the state custodian in 2010, which needed to be maintained and a paucity of resources (human and financial) led the state custodian to collaborate with UwB to increase its distributional outcome as well as ensure maintenance of the newly restored lake.

All these changes in mental models, interrelated institutions and governance technologies reduced the transaction costs for both the state custodian and non-state actors, especially the community members. There was a drastic reduction in transaction costs for the state custodian by providing rights to the community to undertake monitoring and maintenance activities at the lake, increased the perceived benefits to negotiate a new institutional arrangement with the

non-state actors. The perceived benefits involved securing funding for undertaking day-to-day activities and preventing encroachment of the lakebed. Thus, this collaboration helped reduce the transaction costs for both the state and community to organise a heterogeneous community based on a shared understanding of the lake. UwB also reduced the transaction costs for the state custodian by securing funds through corporate social responsibility schemes. Further, UwB also reduced the costs incurred for awareness creation among the community and gathering information regarding lake management, improving the distributional outcomes for both the state and community to cooperate for lake management.

2.4.2.2 Peri-urban Lake

Biophysical changes: Byramangala lake, located 40 kilometres downstream of the urban lake is a recipient of treated wastewater due to natural gradient of the region. The lake is one of the largest and important lakes in the watershed is mainly used for irrigation and was expanded in 1946 to irrigate an area of 1949 hectares in four villages located on the banks of the lake. Upstream urban and surrounding development has led to an inflow of treated wastewater into the lake, increasing the quantity but reducing the quality of water. The irrigation department has expanded the irrigation channels up to 12 kilometres away from the lake, adding new dependents (farmers) on the lake. The development of a special economic zone (SEZ) in one village has reduced their dependence on the lake with only 12% of the population engaged in agriculture, compared to the others three villages with over 60% dependence. Further, this village has been merged with the nearest town, adding to the diverse administrative overlaps, as the other three villages fall under two different administrative jurisdictions which are all responsible for the lake, but only within their administrative boundaries, adding to the complexity.

Actors: the main actors involved are irrigation department (henceforth MiD), who is the state custodian of the lake and the communities from villages along the banks (traditional users) of the lake and the newly added users (new users). The town municipality has not gotten actively involved in issues related to the lake, thus, we omit this actor.

Changes in Ecosystem services: there have been changes in the ecosystem services derived from the lake. There has been a loss of social and cultural services derived from the lake due to the inflow of wastewater into the lake. Now the lake is used only for its production capacities due to the available of water and is an important source of irrigation and both traditional and new users. The production related services derived from the lake have economically benefitted

the users due to the increase in the number of crops grown and a decrease in use of fertilisers and pesticides. With the inflow of wastewater, there has been a change in the social and cultural services derived from the lake, as the lake has transformed into a perennial source of wastewater with negative health impacts. The fourth village, which has been amalgamated into the nearby town, indicates a drastic change in the services derived as the community highlighted that they are no longer dependent on the lake, and they want the lake to be filled-up and the land used for development.

Negotiation of new institutional arrangement: There has been no change in institutions regarding community engagement and participation in lake managements.

The lake is an important source of irrigation and both traditional and new users have economically benefitted due to the increase in the number of crops grown and a decrease in the use of fertilisers and pesticides (as highlighted by the community during focus group discussions). There are multiple mental models associated with lake among the community actors involved. Though there is increasing awareness, especially among the traditional users on the ill-effects of using this water, the community is of the opinion that economic development increases their access to better health facilities, as quoted by a traditional user, *“the financial benefits are far greater than the health risks. In case of any health issues, we use money to get it treated...”* New users indicate that the availability of water because of expansion on irrigation channels has increased agriculture and allied activities in their villages, providing a chance of better life. Thus, they are very content with the status quo and, as indicated during community discussions, changes to the lake proposed by the traditional users are opposed by the new users, fearing a *“reduction in water availability and their chance at a better life”*. Thus, the perceived benefits of the lake by both the traditional and new users are far higher than the perceived costs of governance.

There have been changes in the interrelated institutions adopted by the state, increasing the transaction costs for actors to get involved. This is seen with the abandoning of collection of ‘water cess’³ in 2000 due to increasing pollution in the lake (BET Report 2018) and the increasing quantity of wastewater, used widely for irrigation increased the costs for the state to manage the lake, leading to callousness of officials. This has resulted in scepticism among the community towards the state, as to who is responsible and who to contact in case of need, as was indicated during interviews with the community *“... they say an engineer is responsible*

³ Water cess is collected by the state from users to ensure effective management of the lake

for the lake, but I have not seen him till date...” Further, the community indicates an increase in the callous attitude of officials and the role of state custodian over the years as indicated by a community member *“when I was 10 years old, the engineer would come at least four times a week, not I am 45, and I have not seen an engineer in the past 20 years...”* These have led to an understanding among the community that the state is not interested in the lake. Thus, increasing scepticism among the community members towards the state.

Further, urbanisation has led to a situation where the lake is located under multiple overlapping jurisdictions. This is highlighted by the case as three of the villages depend heavily on the lake for livelihood and one village, which was merged with the town municipality, which called for filling-up of the lake as they were not using it. These views are amplified by the diverse administrative jurisdictions as indicated by a member of the panchayat⁴ *“... one panchayat cannot do anything about this lake... the state has to get involved...”* This has been further aggravated by the complexities associated interrelated institutions across the administrative jurisdiction with limited interactions and the addition of new users, who are against any intervention to reduce the quantity of the water in the lake as they fear a loss of water for irrigation. All these factors have increased the transaction costs of interactions, reducing the positional power of the community to act. The trade-off for economic well-being by the community, coupled with administrative overlaps and scepticism has increased their distributional outcomes to not negotiate a new outcome for lake management.

2.4.2.3 Rural Lake

Biophysical Changes: Ramanahalli lake is located 45 kilometres from the city and 4.5 kilometres downstream from the peri-urban Lake is a recipient of wastewater from upstream urban and peri-urban areas, which has increased the quantity but decreased the quality of water. The lake is an important source of irrigation in the village and the availability of water has led to an increase in number of crops grown in a year (two to four crops) and continues to employ nearly 70% of the population dependent on agriculture and allied activities for their livelihood (GoI, 2011).

Actors involved in negotiations on issues related to the lake are homogenous and dependent on farming and the state custodian of the lake (Minor Irrigation Department, MiD).

Changes in Ecosystem services: like in the peri-urban lake, there have been changes in the ecosystem services derived from the lake. There has been a loss of social and cultural services

⁴ The lowest administrative body governing a group of villages.

derived from the lake due to the inflow of wastewater into the lake. Now the lake is used only for its production capacities due to available of water.

The lake is still the main source of irrigation, and the availability of wastewater has ensured continued agricultural livelihoods in the village, ensuring a nearly homogeneous population, dependent on the lake. Farmers have adapted their cropping patterns to grow up to four crops a year with the use of wastewater as indicated by community members during discussions “*we cannot grow crops which we used to grow, so we have shifted to more commercial and fodder crops... and now we grow four crops*”. The change in cropping pattern has increased the economic well-being of the community, leading to an increase in the values associated with the lake as a source of irrigation. The community valuation of the lake changed with inflow of wastewater, as the primary production based ecosystem services have remained the same, due to availability of water augmented by the inflow of wastewater. But there has been a change in the social and cultural services derived from the lake due to inflow of wastewater.

Negotiation of new institutional arrangement: the community could negotiate a new institutional arrangement to ensure their engagement in lake management by overcoming state scepticism towards the community. This was achieved by building trust based on information exchange and deliberations at the village meetings.

As seen in the case of peri-urban lake, there is a trade-off between the economic benefits of using wastewater for health issues, but there is also a divergence of thoughts among the community on the need for clean water. These diverse attitudes was highlighted during group discussions with the community “*forget the bad odour as the water is contaminated... this water is of great help to us ‘the farmers’*”. There is an increasing divergence of this value among the community with a certain section highlighting the ill effects of contaminated water “*...not only people are falling ill, but even cattle are dying using this water...*” Even though there is divergence among the community regarding their understanding of the use of wastewater, there is a common acceptance that lake is integral to the village and their livelihoods.

The shared understanding of the importance of the lake, coupled with increasing awareness about the role of community in lake management, has reduced the transaction costs for the community to engage with the state. There has been a change in the mental models of the community who now perceive that they can play an active role in lake management, due to awareness and motivation to work with state agencies. This has led the community to nominate

a “*field officer*” responsible for gathering information on various government policies and schemes regarding lake management. The field officer acts as a liaison between the state and community, thereby building trust among the state officials regarding the intentions of the community. Information gathering, mainly from state agencies has led to deliberation and active contribution by the community on issues and identify collaborative solutions for lake management at village meetings. This has increased the distributional outcomes for the state custodian to overcome scepticism and negotiate a new institutional arrangement with the community. This increased deliberation and trust towards the community by the state has led to the creation of a second lake within the village built by the community using funds under various government schemes, and this lake is completely managed by the community. The building of the second lake and its management by the community has increased the distributional outcomes of both the state and community actors to negotiate a new institutional arrangement based on cooperation.

All of this was made possible by the availability of the institutional structures such as village meetings (Gram Sabha) by interrelated institutions such as the Karnataka Panchayat Raj Act 1993 and the 73rd Constitutional amendment in 1992. These institutions provide the basis for establishing village institutions wherein state agencies are mandated to attend and discuss development plans and budgets allocated under various schemes and policies. Thus, the community used this space for participation to share and discuss ideas related to lake management overcoming state scepticism by reducing the perceived costs for the state to work with the community. This increased the distributional outcome of the state to collaborate with the community by negotiating a new institutional arrangement of community engagement in lake management.

2.4.3 Overarching Discussions

From the illustrated cases above, we clearly demonstrate that urban transformation of Bengaluru has led to changes not just in the biophysical setting but also gradual repositioning bargaining powers of actors. We see that the first-tier variables are all interlinked and a change in one influences the others. From the cases, we highlight that change in the distributional outcomes lead to cooperation and engagement between the state custodian and the community in urban and rural cases. This is made possible by negotiating an arrangement whereby the community and the state overcome their scepticism of working with other actors, respectively. We also highlight that the role of the state is higher in the urban areas, where sceptical and disjoint community was organised with the help of a third-sector organisation. This is in

contrast to the rural case, where the community had to fight state scepticism of engaging with the community through information exchange and deliberation.

Urbanisation has brought with it complex interrelated institutions (Nagendra 2016), coupled with changes in technologies of governance, which have influenced community engagement and participation in lake management. We contribute to the literature by focusing on our stylised action situation of community engagement and participation through the lens of the distributional theory of institutional change. We see that the inflow of wastewater into rural and peri-urban lakes has altered the distributional outcomes for cooperation among the community. The increase in the quantity of water has led to communities making a trade-off based on the perceived benefits of using this water due to their higher dependence on the lake for agriculture. The community overlooked critical costs associated with using this water, in the expectation that the economic gains will cover any negative impacts on health. Though there is growing awareness on the negative effects, there is a stark difference in the way communities along the gradient perceive their distributional outcomes. As is seen in the rural case, a near homogeneous community dependent on the lake were able to start negotiations with the state agencies by organising themselves, increasing their credibility and positional power by information gathering and deliberation with state ensuring their participation in lake management. The peri-urban communities, though dependent on the lake, could not collaborate due to increasing heterogeneity, lack of interaction, and overlapping administrative jurisdiction, thus they are unable to organise themselves and negotiate a change. In the urban case, we see that a disjoint and alienated community was organised into an active contributor to lake management with the help of a third-sector organisation brought in by the state. Thus, institutional development is highly contextual and can be achieved by both bottom-up and top-down initiatives (Easterly 2008; Grief and Laitin 2004).

As highlighted by North 2005, institutional change is path dependent, which as indicated by Challen and Schilizzi 1999, determines the cost involved in changing this existing institutional structure. The same is reflected when comparing our cases, where we see that the perceived costs of institutional change in the rural case were lower because of higher dependence on the lake by the community and a greater awareness leading to changes in mental models of the community. Urban development has increased the transaction costs in urban and peri-urban cases, further reducing the perceived benefits of the community, preventing them from engaging with the state to negotiate a new outcome. As indicated in the literature Zimmer et al. (2008), Evers and Laville (2004) the high costs of transaction to organise a heterogenous

and disjoin urban community were reduced by the presence of third-sector organisation who had to build trust and awareness among the community changing their valuation of the lake create a platform for engaging with the state and identify an alternative mode of co-managing the lake. Thus, across the cases, we see utility of the lakes changed due to changes in the biophysical systems with urbanisation. Further, changes to the established uses/valuation of the lakes were altered due to intentional actions of actors, which required a reduction in the costs and increase not just in the perceived benefits but also the outcomes by changing the institutional structures based on services derived from lake.

The selected cases represent diverse heterogeneity, not just in terms of their geographic location, but also bio-physical and socio-economic and governance characteristics, as listed in Table 1. We see that in the homogenous rural case, the same institutional structures perform multiple functions. Whereas in the peri-urban case, overlapping institutional structures perform multiple functions, leading to a gap in the actions of the actors thus, increasing transaction costs. In the urban case, we see that the third-sector organisations reduce costs of interactions among actors. Overall, along a spatial gradient, we see that there is an increase in heterogeneity and formalism as indicated by Riggs 2006, lowering the effect on actor behaviours with changes in norms. This can be changed, with the presence of a third-sector organisation, as is seen in our urban case.

2.5 Conclusion

We live in a world of rapid urbanisation, which is creating conditions for socio-economic growth and overall development, but as is seen, its consequences are distributed unevenly (Brelsford, Lobo et al. 2017). Urban growth and development have had a greater influence on power asymmetries and distributional outcomes. Scepticism towards state agencies to manage the lake was identified as common conflict across the cases, which was overcome by a community driven approach in the rural case in contrast to a more top-down approach in the urban case. Another major issue is the abundance of wastewater, which has led to continued agricultural practices on the outskirts of the city, thus retaining a rural livelihood. It is important to understand that the quality of water plays an important role besides the quantity, especially where the governments start to focus on rent-seeking and corruption. In such situation there is a need to consider the importance of nature-related transactions, specifically focusing on how changes in the eco-institutional setting influences power asymmetries among actors engaged in negotiating a change in established institutional structures.

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3. Chapter 3: Legitimacy, shared understanding, and exchange of resources: Co-managing Lakes along an urban-rural gradient in Greater Bengaluru Metropolitan region, India

Abstract

Co-management is increasingly seen as a way forward in natural resource management and collective goods provisioning, especially in the management of urban commons. Co-management entails sharing of power between actors, including elements such as exchange of information and resources as well as changes in regulations favouring the development of common goals among actors. In this paper, we try to understand if and how preconditions of legitimacy, shared understanding and exchange of resources combine to facilitate the co-management of lakes in Greater Bengaluru Metropolitan Region (GBMR), India. To understand these issues, we undertook an exploratory, qualitative analysis of the governance of three lakes located within a single watershed placed along an urban-rural gradient. We provide an exploratory assessment of co-management across the cases situated in diverse contexts, highlighting the importance of heterogeneity of socio-economic settings for co-management of lakes. Community involvement in co-management varies with heterogeneity, correspondingly increasing transaction costs. In urbanising contexts, state actors have started to recognise the political efficacy of non-state actors mobilising knowledge and financial resources for lake management. Involvement of the state custodian and third-sector organisations (NGOs) were found to be crucial in developing and facilitating shared understanding. Deliberation between mutually dependent state and non-state actors was key to overcoming scepticism in order to realign actor perspectives. We highlight that increased acceptance of community participation based on the development of a collective identity and understanding of mutual dependence observed in our urban and rural cases reduced transaction costs and thus enabled co-management.

Keywords: *India, water co-management, Greater Bengaluru Metropolitan Region, legitimacy, Shared understanding, exchange of resources.*

3.1 Introduction

Co-management or collaborative governance systems are increasingly seen as a response in circumstances facing drawbacks of hierarchical state led governance (Ansell and Gash 2007; Sandström et al. 2014), especially in the last decades due to declining budgets (Clark et al. 2013; Foster 2013; Sundeen 1985) and increasing awareness of the limitations of privatisation (Clark et al. 2013). Co-management is considered an alternative more frequently in urban regions due to diminishing enforcement and increasing non-compliance of regulatory standards when it comes to resource governance (Foster 2013). There are numerous definitions of co-management; all of them refer to co-management as a range of arrangements, with different degrees of power sharing for joint decision-making by state and users (non-state) about a resource or an area (Berkes et al. 1991; Borrini-Feyerabend et al. 2000; Carlsson and Berkes 2005; Singleton 1998). The basic idea behind co-management is the need for an element of interaction between state and non-state actors through formal regulations and/or informal deliberations (Mees et al. 2018) that ensures actors' right to decision-making regarding management of the resource (Carlsson and Berkes 2005). In this paper, we define co-management as *a partnership between state and non-state actors requiring direct and active contribution by all actors to ensure effective resource management*. From the perspective of public management, emphasis is placed on the partnership between stakeholders to achieve societal goals (Osborne and Stokosch 2013) attaining better quality, increased service satisfaction and public trust (Fledderus and Honingh 2016).

Co-management has developed as partnership arrangements, where non-state actors (communities and third-sector organisations) based on their capacities and interests complement the ability of the government in providing legislation, monitoring and enforcement (Pomeroy and Berkes 1997). This entails that not everyone is willing to collaborate; this depends on their motivation, trust and acceptance (Fledderus and Honingh 2016). Scholars have shown that actors actively participate when they understand why their engagement matters (Mees et al. 2017; Porumbescu et al. 2020). This understanding depends on individual capabilities and resources (human and financial), which has been shown to have a positive correlation towards formation and support of co-management (Cheng 2019; Paarlberg and Gen 2009). Further, as pointed out by Ostrom (1990), the returns obtained when actors collaborate and coordinate their strategies to manage a resource are much higher than when they stay unorganised, which could then lead to the destruction of the resource. Scholars are increasingly focusing their research on understanding the determinants of co-management, the bulk of these

studies focus on single case studies (Ansell and Gash 2007), with comparative case studies beginning to be undertaken recently (e.g. Sandström et al. (2014)).

This paper attempts to understand how participation (legitimacy), shared understanding and exchange of resources among actors influence co-management using an exploratory analysis of three interconnected lakes along a rural-urban gradient and their comparison on an analytical level. We focus on lakes within the Greater Bengaluru Metropolitan Region (GBMR), as lake management has undergone significant changes since lake “ownership” was taken over by the state through passing of Karnataka Land Revenues Act in 1964. Over the years, due to limited budgets and rapid urbanisation, lake management was neglected, leading to leasing of lakes to private actors. This was highly criticised by concerned citizens and NGOs, taking a judicial recourse to protect and conserve lakes. These activities started off by informal groups of residents, they have developed into a network of groups that support through sharing experiences, advice and contacts (Enqvist et al. 2016). These groups advocate for greater participatory arrangements leading to some of them signing a memorandum of understanding with the city administration to share responsibilities of lake maintenance and monitoring (Luna 2014). This, coupled with a push for decentralisation by the Indian government, has led the state to accept participation of non-state actors in lake management in some cases, which forms the basic premise of this paper. Against this background our research question concerns what role the three variables of legitimacy, shared understanding and exchange of resources play in determining co-management. For the three categories of variables that we consider we find that each of them is necessary but not sufficient for co-management to emerge. Further, we find that salience of particular demands on the lake is crucial in motivating direct and active participation while necessary efforts (transaction costs) of organizing for co-management are crucially determined by the contextual aspect of socio-economic heterogeneity of the community of users at stake.

3.2 Conceptual Framework

In this paper, to explain our inquiries on how legitimacy, shared understanding and exchange of resources among actors influence co-management, we adapt and modify the framework for diagnosing adaptive co-management by Plummer et al. (2017) and the model of collaborative governance by Ansell and Gash (2007). The framework illustrated in Figure 4 aids us in our inquiry of cross-case empirical questions of how the variables of legitimacy, shared understanding and exchange of resources (independent variables) facilitate co-management of lakes along a rural-urban spatial gradient. Socio-economic characteristics and biophysical

context that shape activities and practices of actors involved are included as contextual conditions in the ‘case setting’.

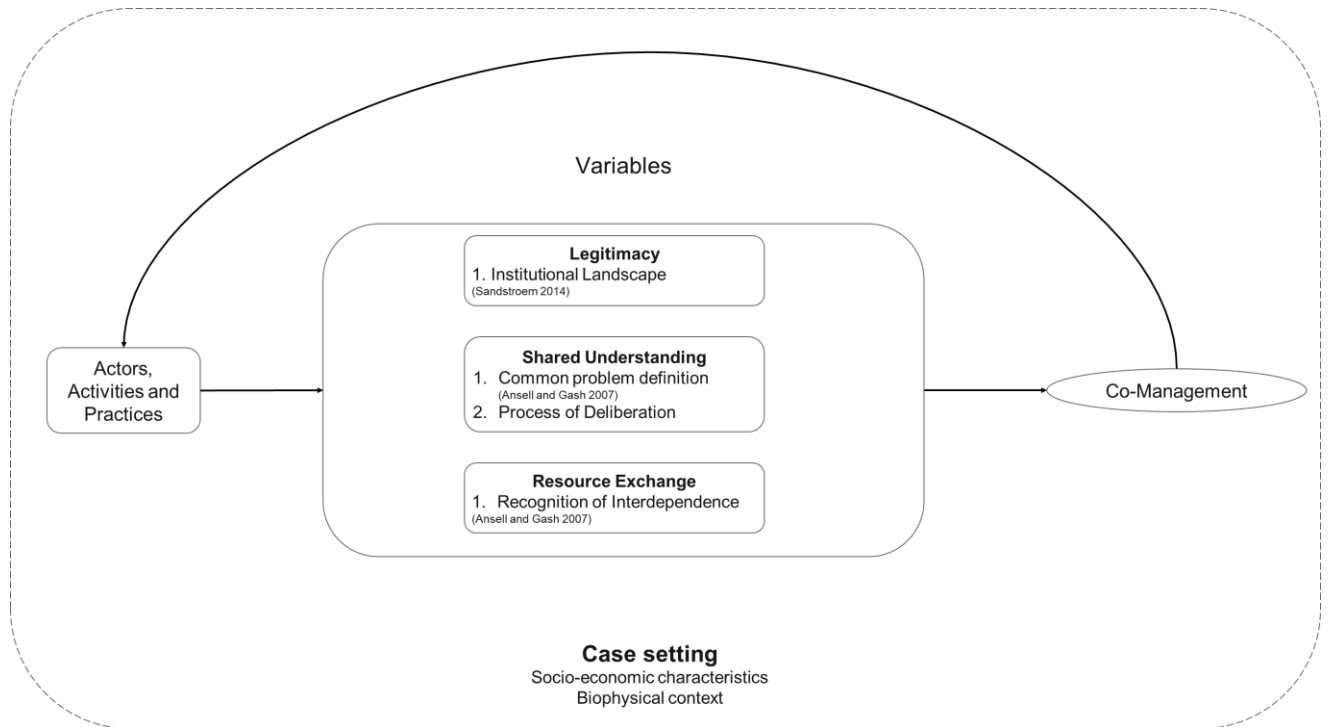


Figure 4: Framework used to understand the process of co-management along a rural-urban gradient (modified and adapted from Plummer et al 2017)

We focus on both state and non-state (e.g. third-sector organisations such as community organisations, Non-governmental organisations) actors, in line with our definition of co-management, which highlights an engagement between state and non-state actors leading to collective action with direct and active contributions by all involved actors. Drawing on an extensive literature review on the determinants of co-management, we consider three main variables, namely, Legitimacy (Birnbaum et al. 2015; Sandström et al. 2014), Shared understanding (Ansell and Gash 2007) and Exchange of resources (Carlsson and Berkes 2005; Stoker 1995), to explain the presence or absence of co-management. In the process we acknowledge that, naturally, co-management can take shape in different forms. We are aware that these three variables can be considered interdependent. For example, legitimacy can be seen as an outcome of common understanding (Sandström et al. 2014). However, in order to ensure that we measure different things that do not necessarily follow from each other we operationalised the variables in a way that minimises overlaps and redundancies. Thus, we argue that independent observation of any of these variables in the way we operationalised

them is well possible and that none of them is a sufficient condition neither for any other variable determinant of co-management that we investigate here nor for co-management itself.

Legitimacy

Legitimacy defined as acceptance and justification of participation as indicated by Sandström et al. (2014) and Bernstein (2005), is considered an essential precondition central to collaboration (Jentoft 2000; Sandström et al. 2014) as it validates the representation and participation of societal actors (Hermans et al. 2021). As co-management is seen as a partnership, where state and non-state actors complement their ability based on individual capacities (Pomeroy and Berkes 1997), legitimacy plays a crucial role in enabling this partnership. This is especially due to increased push for decentralisation by policy makers and the communities themselves, especially regarding resource management (Cheng 2019; Foster 2013; Pomeroy and Berkes 1997). Among others, such a push for greater involvement of non-state actors requires establishing proper legal rights for them (Williams et al. 2016; Foster 2013; Pomeroy and Berkes 1997).

In this paper, following a normative view of legitimacy, we focus on the structures that lead to input legitimacy, which rely on participation (Johansson 2012). Input legitimacy focuses mainly on assessing if the extent to which the actors affected by decisions were involved in the process of decision-making. Our indicator is *Institutional Landscape*, which we measure as “existing institutions, organisations and collaboration structures” that cater for participation of state and non-state actors in the process of co-management (Sandström et al. 2014).

Shared understanding

Shared understanding is a crucial factor for stakeholders of co-management to identify a common purpose to work towards. As pointed out by Ansell and Gash (2007), shared understanding among stakeholders of what they can collectively achieve together is indispensable within a collaborative process. Shared understanding leads to what Mosimane et al (2012) call collective identity. Collective identity among the members of a co-management group increases cost-effectiveness of co-management and cooperation by reducing transaction costs. As pointed out by Pahl-Wostl and Hare (2004), shared understanding implies an agreement on a definition of the problem, or might indicate the consensus on the necessary knowledge required to tackle a problem. Porumbescu et al. (2020), Mees et al. (2018) and Mees et al. (2017) indicate that actors are inclined to collaborate when they understand why and how their involvement helps achieve the outcomes. Scholars such as Pomeroy and Berkes (1997),

highlight that shared understanding requires overcoming scepticism mainly among government officials ‘on the lack of appropriate knowledge and know-how on part of the users’ reducing uncertainty and enhancing the credibility of non-state actors.

In this paper, we try to assess shared understanding among actors involved based on the indicators of *common problem definition* (Ansell and Gash 2007) and *process of deliberation*. We measure common problem definition based on the presence or absence of re-alignment (Sandström et al. 2014) of actors goals in the process of developing shared understanding. We measure process of deliberation through presence or absence of “mutual communication that involves weighing and reflecting on preferences, values and interests regarding matters of common concern” (Mansbridge 2015). It may or may not build on the institutional landscape but concerns the process of communication .

Exchange of resources

Resources play a critical role in co-management (Bovaird and Loeffler 2012) and community resources (human and financial capital) play a crucial role in increasing the likelihood of formation and support to their participation in co-management (Cheng 2019; Paarlberg and Gen 2009). Co-management relies on the idea that citizens represent a “huge untapped resource” which can trigger innovation and assist in formation and support of collaborative relationships (Boyle and Harris 2009; Nabatchi et al. 2017; Paarlberg and Gen 2009). The importance of resources for co-management is founded within two theories namely, theory of power relations and theory of resource dependency (Carlsson and Berkes 2005). The power differentials due to asymmetries in resource allocation between actors is what leads to exchange and dependence (Johnson 1995). As emphasised by regime theorists, access to resources is what makes certain actors attractive for collaboration (Stoker 1995). Collaborative relationships are established to overcome lack of resources by an actor with those who have access to resources, and are successful when there is an understanding that the gains achieved by pooling individual resources are beneficial to all actors involved.

In order to measure exchange of resources, we defined the variable *recognition of dependence* which we measure through presence or absence of different kinds of Salience and Efficacy. Both these measures influence actors’ motivation to engage in co-management. Salience refers to “actors’ perceiving a topic as important enough to consider active engagement and weighing their investment” (van Eijk and Steen 2016). We focus on both personal salience, “individuals perception of how the service affects him/herself” (Pestoff 2012 as quoted by; van Eijk and

Steen 2016) and social salience, “perceived importance of the issue to one’s neighbourhood, community or society at large” (van Eijk and Steen 2016). Efficacy refers to the perception of actors to make a difference. We use both personal (where actors believe that they themselves can make a difference) and political (where actors believe that people can make a difference) efficacy (Bovaird et al. 2016). Further, we consider aspects such as how actors managed a shortage of resources (such as funding, expertise and knowledge), through pooling of resources (Imperial 2005) among actors involved in the process to understand the influence of resource exchange on co-management.

3.3 Material and Methods

3.3.1 Case selection and description

Bengaluru is one of the five megacities⁵ in India, with an estimated population of over 13 million in 2022 (World Population Review 2022). There has been a massive increase in urban population from 44% in 1901 to 90.9% in 2011 (Puttalingaiah et al. 2019), resulting in rapid urbanisation of not just the city but the region as well, creating an urban agglomeration. The city covers a spatial area of 741 sq. km and the metropolitan region covers 8005 sq. km. The metropolitan region termed GBMR, spans over three administrative areas (Bengaluru Urban, Bengaluru Rural and Ramanagara districts). The drastic transformation of Bengaluru from agrarian context to an urban agglomeration during the last four decades was augmented by economic reforms and growing employment opportunities since the liberalisation of India’s economy in 1991. This urban transformation and economic development has had serious environmental impacts (Sudhira and Nagendra 2013). An analysis of the urban dynamics between 1973-2017 by Ramachandra et al. (2019) highlights 88% decline in vegetation and 79% decline in water bodies with increasing urban areas. The loss of water bodies and lakes is of particular concern for the region as there are no major rivers around the metropolis (Enqvist 2017). Lakes are man-made, by building of bunds and dams across small seasonal streams, along the undulating terrain of Bengaluru, which safeguarded the local communities to continue agriculture and rear cattle throughout the year (Nagendra 2016), in addition to regulating the micro-climate of the city. In order to minimise degradation of lakes across the region various citizen groups have started to collaborate with state authorities, with varying levels of participation. Thus, GBMR provides us with a living laboratory to undertake research in our effort to understand co-management in an urbanizing local environment.

⁵ Any city with a population more than 10 million is termed Megacity by UNDESA (2019)

We use multiple contrasting case studies (Yin 2018), allowing us to compare the process of co-management of three lakes in GBMR. On an analytical level, this implies that we can identify underlying common abstract variables driving co-management rather than drawing conclusions from direct comparison of observations. Direct comparisons are difficult because of the great difference in the context of the lakes. The selected lakes differ in their geographical location, population density, socio-economic and biophysical characteristics highlighted in Table 3. The variations of socio-economic variables and population densities are aligned with our corresponding expectations along an urban-rural gradient with population densities being greatest in urban areas, less dense in the peri-urban area and least in rural areas while socio-economic heterogeneity, for example, is greater in the urban and peri-urban area in comparison to the rural area. The lakes are located within a single (Vrishabavathi) watershed, which is a major outlet for both domestic and industrial wastewater, converting a once seasonal stream into perennial source, ensuring continued agriculture-based livelihood (Jamwal et al. 2014; Lele et al. 2013).

Table 3: Socio-economic characteristics of communities adjacent to lakes and biophysical characteristics of the lake across the three cases

	Socio-Economic Characteristics				Biophysical Characteristics		
	Population Density (number of people living per square kilometre)	Literacy Rate (%)	Predominant livelihood	Dependence on the lake for livelihood	Ecosystem services derived from the lake	Water Quality	Water Quantity
Urban Lake	6218	76.4	Diverse urban livelihoods	Low	Cultural and Recreational Services	Wastewater is diverted from the lake	Regulated
Peri-urban Lake	Average across the four villages in 516.43 (highest is 791 and lowest is 297)	Average for four villages 66.61 (High 72% and low 60%)	65% in three villages and 12% in the fourth village engaged in agriculture and allied activities	Mixed	Production based services	Wastewater from upstream urban and industrial areas	Unregulated leading to abundance
Rural Lake	391.28	63.6	69.6% depend on agriculture and allied activities	High	Production based services	Wastewater from upstream urban and industrial areas	Regulated

Below, we provide a brief description of the three selected lakes, highlighting their socio-economic and biophysical characteristics, thus describing the case setting, which is summarised in Table 1.

Urban Lake: located in one of the most densely populated areas of the city, the lake was created in 1869 for irrigation (Center for Lake Conservation 2018). The socio-economic characteristics changed as the area around the lake grew tremendously since 2001 with a

decadal population growth of 161.9% and a household growth of 176.3% (2001-2011) (Census GoI 2011). The residents comprise of heterogeneous community, consisting of people from diverse economic, social and educational background (refer Table 1) speaking diverse languages and working in private or public sectors. The new residents were unaware of the lake nearby or its benefits to the local ecology; hence, they never connected to the lake as compared to older residents. Biophysical context highlights that the lake is no longer a recipient of wastewater, since its restoration by the city administration in 2009-10, as water inflow was modified by diverting wastewater away from the lake. The citizens derive recreational and cultural services, as they are not dependent on the lake for their livelihood. The city administration in 2010 signed a Memorandum of Understanding with a third-sector organisation to ensure day-to-day management of the lake.

Peri-Urban Lake: Located downstream from the city, the peri-urban lake was expanded in 1946 increasing its capacity to irrigate fields belonging to four villages. Biophysical context of the lake transformed with inflow of upstream wastewater (domestic and industrial) since late 1990s, converting it into a perennial lake. The role of the community dwindled greatly since the official takeover of lakes by governments in 1964. It was abandoned *with the conversion of the lake into a perennial source* of water. Socio-economic characteristics of the actors vary across the villages (Table 1) in the area, with the lake being an important source of livelihood in three of the surrounding villages as 65% of the population are dependent on agriculture and agricultural labour for their livelihoods (Census 2011 and corroborated during interviews). The fourth village is under the jurisdiction of the nearest town and has an industrial estate located along the banks of the lake. This has resulted in decreased dependence on agriculture with only 12% being engaged in agriculture (Census 2011, GoI) due to possibilities of new opportunities as indicated by community members during group discussion.

The state stopped collecting irrigation water cess⁶ in 2000 (Bangalore Environment Trust 2020). The reasons were increased levels of pollution, prompting the state to give up monitoring and enforcement of regulations for lake management. In order to manage the water quantity of the lake, the state custodian expanded irrigation channels creating new users who consequently started to have a say in lake management.

⁶ Water cess collected as a means of betterment contribution from those who were benefiting from the irrigation work ensuring the government maintains channels and other infrastructure.

Rural Lake: The rural lake is a recipient of the outflow of wastewater from peri-urban lake. This has transformed the biophysical context by increasing water quantity thus, converting a seasonal lake into a perennial source. The availability of (polluted)water has maintained the community intact, and provided stability to socio-economic characteristics of the rural communities, with a majority 69.6% of the population dependent on agriculture and associated activities (agricultural labour and dairy industry) as their main livelihood (GoI 2011). The lake water is used to irrigate four crops a year, (Interview, FGR1, 2018; corroborated during field visits). There is a trade-off between economic benefits over health issues by the community, leading to minor differences among members, resulting in construction of another lake in 2014 along the wetlands collecting clean water in the village (this lake is not the focus of this paper).

3.3.2 Data collection

Qualitative data was collected through key informant interviews and focus group discussions, conducted in 2018-19. Purposive sampling was undertaken to identify respondents, classified into state and non-state actors. We identified non-state actors by visiting the lake and talking to residents identifying key members of the community or third-sector organisations involved in lake management. Documents and interviews led to identification of state actors. Following our definition of co-management, we focused on actors actively involved in day-to-day management of the lake, which led us to identifying designated state custodians who had a direct role in lake management. Thus, we narrowed down from a large mosaic of state agencies responsible to two main state custodians and the views of officials was considered to be representative of the agency.

Key informant interviews were held with state officials across the three cases (N=5 custodians; N=5 officials of local administration in peri-urban and rural), representatives of the citizen groups in urban case (N=5), researchers and academics (N=4), representatives of NGOs (N=7). Focus group discussions were undertaken in rural (N=2) and peri-urban (N=5) communities. The number of focus group discussions in the peri-urban case is greater due to the presence of four villages along the lake. Three of the four villages are dependent on the lake for their livelihood, whereas the fourth village comes under the administrative jurisdiction of the nearest town and is home to an industrial estate, with limited agriculture. During interviews and discussions, respondents were asked about their role in lake management, presence of platforms for participation, practices of stakeholder participation, acceptance, and openness

towards inclusion of local knowledge, reasons for collaborations. We also reviewed data from secondary sources, such as formal laws, policies, rules, and regulations in addition to research and academic contributions. The interviews and discussions lasted between 45 minutes to 2 hours, were transcribed and coded using Nvivo.

3.4 Results

In this section, we explain the presence or absence of co-management based on the above framework. Accounts for each lake first describe actors, their activities and practices, the observation of variables of legitimacy, shared understanding and exchange of resources before we assess presence or absence of co-management and describe its particular form.

3.4.1 Urban Lake

Actors, Actions and Practices

There are three main actors, directly and actively involved in managing the lake, namely: City administration (State custodian, henceforth BBMP), United Way Bengaluru an NGO (henceforth UwB) and local community association (henceforth, LCA). We first describe the actions and practices of the state actor followed by the non-state actors.

BBMP as the state custodian is responsible for decisions regarding day-to-day management, including removing encroachments, maintaining bunds, embankments, and the area around the lake. In 2010, it invited UwB to sign a MoU to secure finance from private actors and organise the heterogeneous local community by creating awareness. The MoU defines BBMPs role as provider of infrastructure (embankments, bunds...) needs, in addition to ensuring that no sewage and chemical pollutants enter the lake.

UwB plays a crucial role in securing financial support for lake management. They are known across the city for securing corporate funding, under corporate social responsibility schemes specifically for social issues. As per the MoU, they are also responsible to create public support and generate public participation in activities concerning the lake. They organised a heterogeneous community into a local association, who were made a signatory to MoU in 2017. UwB organises numerous activities, by working with local elected representatives and community leaders involving both corporate volunteers and local residents. These activities (information sharing events, tree plantations, educational walks for local schoolchildren and so on) have led to exchange of perspectives and alignment of values, among actors.

The LCA is responsible for general housekeeping activities of the lake. According to the MoU, they are responsible for providing security, maintaining the area free from garbage and monitor encroachment. According to community members, “LCA has become the face for the community and help in information exchange between the residents and other actors involved”

Assessment of pre-conditions of co-management

Legitimacy

The institutional landscape for participation in urban areas is enshrined in the 74th Constitutional Amendment act, which mandates devolution of power to city governments (Urban local bodies) establishing and empowering ward⁷ committees (Interview TS3, 2018). Any citizen may approach the committee for addressing issues related to public and ward development and the committee is obliged to meet once a month (Karnataka Gazette 2016). According to community members “Though there is the provision for ward committee, its establishment has been slow, and committees are not even formed.” The same is the case in our urban lake as indicated by a member of LCA “we are unaware of the ward committee...”

In our case, we see that formal participation is enshrined in the tri-partite agreement signed between the state and non-state actors. It obliges the signatories to “meet regularly” and discuss implementation of individual roles and responsibilities (BBMP et al. 2017). Formal rules of participation were followed as informal rules of participation were not established among actors.

Shared understanding

There is shared understanding among actors developed through the intervention of UwB, who was responsible for generating public support as indicated in the MoU. In this regard, UwB as an outsider had to gather the support of heterogeneous residents by realigning community perceptions of the lake and its management. According to a member of an NGO “The new residents had come to see the lake as an eyesore of the neighbourhood” and had no understanding of the important of the lake to the local ecosystem; the older residents distrusted state intervention. As indicated by members of the NGO “UwB struggled for nearly six months to get the community to participate in activities related to the lake.”. A change and alignment of attitudes among residents was achieved through campaigns, activities to clean the lake and

⁷ Ward committees are the lowest administrative unit of the city and are determined by population, geographical condition and economic status

working closely with the local elected representative, gaining support of local leaders to gain trust of the community. These got residents talking about the lake (common problem definition through realignment of community goals) and they “started to enlist their support in collaborating with UwB...” as indicated by member of NGO. According to a city Official “these activities led to consideration of UwB as a trustworthy partner” and seriously considered suggestions put forward by UwB. Further, as indicated by members of UwB, these activities helped realigning community perceptions of state apathy in lake management, motivating and community members to participate in lake management. UwB organised and established LCA to monitor day-to-day activities such as cleaning, maintenance. The process of deliberation between actors is outlined in the MoU. The actors are obliged to meet once a month to discuss issues, according to members of LCA “we meet once a month to discuss issues and reflect on concerns raised before deciding”.

Resource Exchange

There is a recognition of dependence among actors involved. Researchers and community highlighted that, the state custodian recognises the importance of third-sector organisations to complement state financial support through corporate social responsibility funds and organise the community, highlighting political efficacy. Beyond efficacy, recognition of dependence is illustrated by pooling of resources by non-state actors in the form of securing financial support from corporates and knowledge sharing. As indicated by members of UwB, “every lake is unique and local knowledge plays an important role, [thus] we work with communities to understand the local geography and ecology before planning actions”.

The community considers active participation by actors in lake management to lead to betterment of the neighbourhood (social salience). As indicated by community members “the lake has been transformed into a social space and this also has a positive influence on the real-estate value” UwB follows its organisational motto of working with communities by listening to their concerns and empowering them to act in order to overcome problems. Thus, viewing lake management as crucial aspect of society and believes that people can make a change.

Outcome

In the urban case we can clearly observe co-management. UwB adopts an active role in organising a heterogeneous community on behalf of the state custodian in addition to securing finance from corporates. Even though UwB was invited by the state, its activities have overcome state scepticism previously held by the community. Actors have learnt to consider

each other as trustworthy partners. This has led to pooling of knowledge and finances and community understanding that lake is an essential part of the neighbourhood.

3.4.2 Peri-urban Lake

Actors, Actions and Practices

For the peri-urban lake, we identified, the Minor Irrigation Department (State custodian, henceforth MiD) and non-state actors (communities)– from villages around the lake (traditional users), among whom we distinguish from new user communities who use lake water through irrigation channels. We first describe the actions and practices of the state actor followed by the non-state actors.

MiD is responsible for “decisions regarding management, monitoring and enforcement”, as indicated by an official. The main objective of MiD is to provide water for irrigation from the lake. Thus, they have extended irrigation channels to irrigate farmlands up to 12 kilometres from the lake. The officials no longer monitor or enforce regulations due to high volumes of wastewater inflow.

The community lacks any form of authority and willingness to get involved in lake management due to two main reasons; first, economic benefits obtained from irrigating the land throughout the year have offset the ill effects of wastewater on not just their health, but cattle and soil. Second, the increase in the users, with expansion of irrigation channels. This was done without consultations with the traditional users, which has increased distrust towards the state among traditional users, causing a rift among user communities and inhibiting cooperation among them. Further, while traditional users are willing to contribute to lake management, the new users who fear losing rights to water once the current management regime is modified.

Assessment of pre-conditions of co-management:

Legitimacy

As regards institutional landscape, the structures for participation in rural India are enshrined in the Indian constitution through the 73rd Amendment in 1992, realised through Panchayat Raj Institutions. These consist of institutional structures that devolve powers and responsibilities to village organisations, namely the gram panchayat (village council) which represents the community through direct elections and the Gram Sabha (village meetings) which addresses planning for economic development and social justice (Das 2022). Gram Sabha is the

prominent structure that provides for participation of all adults registered in the electoral role of the village (Das 2022). The village council is obliged to hold at least two general meetings per year, to discuss development plans, budgets allocated under various policies and so on.

In our case, the villages around the lake came under diverse jurisdictions (two village councils and one town council), which organise meetings within their respective boundaries. This institutional landscape of participatory structures, has caused confusion as to who is actually responsible for the lake, increasing animosity between communities. Though the Karnataka Panchayat Raj Act 1993 provides a mechanism for setting up a joint committee between panchayats to solve issues of common purpose based on joint interest, there has been no joint interest shown by the panchayats or the communities. The members of village councils indicated, “If the lake was within one village and we had control over the inflow of water, we could do something about it. But the water comes from somewhere and is utilised by villages up to 12 kilometres... it is difficult to manage it locally.” Thus, ultimately the indicator of institutional landscape for co-management is not observed in the case.

Shared understanding

There is no shared understanding between and within state and non-state actors, explained by the difference in perceptions of the community as to how the state custodian is managing the lake. Traditional users (community) perceive that officials are not interested managing the lake reflected by their statement “ we have been asking for the betterment of the lake, but the officials are not showing any interest” . In contrast, new users are content with lake management, respectively the absence of its management. This has created distrust among users and between traditional users and state actors, further amplified by the lack of knowing “who” to approach. This has been, summarised by community member “... they say an engineer is responsible for the lake, but I have not seen him till date...” Further, diverging views on water quantity also led to lack of common understanding between traditional and new users and the state. The state custodian follows its organisational vision of providing irrigation facilities to maximise utilisation of wastewater, whereas traditional users request for a “reduction in the water quantity of the lake.”. In contrast, new users are sceptical about any changes, and try to ensure continuation of existing practices. We see absence of common problem definition in this case.

Platforms for deliberation are seen as top-down information sharing and these platforms do not fulfil the characteristic of aggregation of stakeholder preferences. There is no platform for

interaction between non-state actors leading to decreased trust and social capital, as indicated by community members “Byr is now a different panchayat, they will get some things approved and they will use the money themselves.” Traditional users indicated that the addition of new users without consultation has “increased diversity and decreased trust between state and non-state actors.” Further, water quantity is a cause of concern as indicated by both state and non-state actors. According to members of village councils and community, “...existing local institutions, organisations and structures are unable to handle the situation and it requires interventions from higher authorities.” Thus, we consider processes of deliberation as absent in this case.

Resource Exchange

There is no exchange of resources between actors explained by lack of salience and efficacy. Members of community perceives the economic benefits from cultivating four crops a year to be higher than to actively engage in lake management. Traditional users indicated that, they would not do anything to harm the new users, as “they are farmers too, they are dependent on the lake just like we are, and we would not want to steal their livelihood.” Thus, indicating importance of the lake to be much larger than the village boundaries, prompting their non-involvement in lake management (social salience). Community within one village under the jurisdiction of the town administration did not want to be associated with the lake, as they indicated, “...we do not have any use of the lake as we are not dependent on it.”. Further, expansion of irrigation channels has led traditional users to perceive that they themselves cannot make a difference (political efficacy) as indicated during discussions “lake water is used by villages for at least 12 kilometres... so it is now not easy for one person or village to do anything.”

Outcome

There is no co-management of the lake mainly due to diverging perceptions among actors as well as increasing dependents due to water availability. Expansion of irrigation channels by state to manage water quantity has led to an implicit recognition of dependence among actors from the perspective that lake management needs involvement of higher authorities.

3.4.3 Rural Lake

Actors, Actions and Practices

We identify two main actor groups, actively and directly involved in lake management namely: MiD (state custodian) and community (non-state actor). The MiD is the designated custodian and performs the activities as in the peri-urban case. Further, MiD is expanding channels within the village administrative boundaries to provide irrigation to farms based on consultation with community member, as channels need to pass through their fields.

Community has had to reclaim their role in lake management since it became a perennial source. To overcome the ill effects (reduction in crop productivity, human health) of using wastewater, the community gathered information to identify alternative practices and ensure crop productivity, leading to changes in cropping patterns (cash crops and fodder for cattle). This need for information fuelled the community to identify a “field officer” in 2014, and to liaise and collect information regarding state policies, regulations and rules (including lake) that are beneficial and share it with them.

Assessment of pre-conditions of co-management:

Legitimacy

The Indian constitution provides the structures establishing participation in the form of local self-government of villages. Similar to the villages in the peri-urban areas, these institutions established under the Karnataka Panchayat Raj Act 1993, provide the legal democratic structure and are tasked with administrative, socio-economic functions, including construction and maintenance of ponds. The Gram Sabha is crucial in providing a platform for participation for all adults residing within the boundaries of villages (Das 2022), establishing a formal platform for participation, where officials are obliged to present their plans for development and have discussions with those directly affected.

In our case, as highlighted during interviews and discussions with members of the community, “the Gram Sabha meets once in six months” as stipulated by law under the Karnataka Panchayat Raj Act 1993. The actors discuss issues related to overall village development and the topic of lake management is key. As indicated by community members, “the community gains most of its information from the panchayat meetings, as all the department officials are present and inform us of various schemes by the government.” Correspondingly, we consider the precondition of institutional landscape as being met.

Shared understanding

In the rural case, the state custodian, following its departmental vision of adequate use of water bodies (Minor Irrigation Department 2022) focussed on providing and expanding irrigation not just to new areas but also to develop existing agricultural lands. State actors viewed communities as ignorant of technical issues and did not consider the community, as there was no formal need to involve non-state actors in lake management. The community did not participate in issues of management as they considered the economic benefits of cultivating four crops. Community members indicated during discussions that “wastewater is of great help to us the farmers, we can grow crops round the year, and we don’t have to spend money on fertilizers and pesticides.” This perception of the community started to change with increasing awareness of ill-effects of using wastewater highlighted during discussions with “not only people are falling ill, but even cattle are also dying...” Thus, the community felt the need to [re]align not just their views of the lake as source of economic well-being but it cohered on a more critical stance towards state officials, who were involved in provision of irrigation channels and did not consider the views of the community or the quality of the water. This [re]alignment of community goals by members can be explained by two reasons: first, the lake is main source of livelihood and has negative impacts on health, as highlighted by the community “lake is the most important source of our livelihood as a majority depend on agriculture.” Second, inspiration drawn from media and news stories of community management of lakes in the (upstream) city, which led to the decision of the community to get itself involved.

In 2014, the urge to participate made the community identify a community member as ‘field officer’ who would liaise with state departments and collect information. As indicated by members of the community, this allowed for better-informed “discussions at village meetings and presenting their case to state actors.” These discussions made state officials take community views seriously (realignment of state goals) which led to increasing community role in regulation of water quantity of the lake. Both state and community actors highlighted that, informed mutual discussions based on information collected and local knowledge has resulted in building of social capital overcoming state scepticisms. Correspondingly, over time, a process of deliberation became observable. As indicated by all actors, state actors have started to view the community as knowledgeable and consider their views. Thus, the community initiative to better liaise with state actors led to realignment of goals regarding the lake. Thus, the variable of common problem definition was achieved.

Resource Exchange

Community recognises its dependence on the state for funds and technical knowledge, as highlighted by members “we lack the technical skills and appropriate knowledge and finances for undertaking large scale efforts of lake management (building bunds, pitching embankments...) these can be complimented with local ecological knowledge within the community.” The community contributes own resources when state funds are insufficient to meet the goals of lake management (pooling of resources). Community members highlighted during discussions “we take government money and when that is insufficient, we collect from the village... the price per household is decided at the village meeting... if households are unable to provide money, they can volunteer to provide manual labour.”

This recognition is based on community understanding that their active engagement is crucial for their household income, as the lake is their main source of livelihood. The community views their engagement in lake management to be beneficial to them as well as the village, indicating personal and social salience of lake management. This was indicated during discussions with community members “water should reach all fields in the village... many people offered parts of their lands to build channels... we are all farmers we understand the plight of others who do not have direct access to water.” The community has come to see that government alone is unable to do things and they play an important role in lake management. Community members indicated that they had seen the “lake deteriorate over the years due to state apathy and inflow of wastewater” and “we cannot blame only the government, even in our own village we are losing community attitude and behaviour... of working towards the betterment of the village.” Thus, featuring both personal and political efficacy.

Outcome

In this case, we observe co-management initiated by the community. The community changed from not participating in lake management to co-management because of its increasing awareness of the ill effects of wastewater and understanding the importance of their participation. They gathered information to interact with officials in village meetings, (common problem definition) and engaged in a process of deliberation leading to co-management.

3.5 Discussion

As expected, we found difference in constellations of co-management of lakes in GBMR and different ways in which legitimacy, shared understanding and exchange of resources were

brought about. Table 4 summarizes our findings. Specifically, we found a mode of co-management led by a third-party organization on behalf of the state in the urban case and a mode of co-management led by the community in the rural case. In the urban case, the third sector organization significantly lowers the transactions costs of cooperation of a relatively heterogeneous community. Despite limited benefits perceived by some members of the community, that way co-management is induced through development of a shared understanding. In the process, particularly state officials recognize the political efficacy of the community and the value of mobilizing its knowledge of the lake. Co-management therefore emerges as a result of significant initial investments into lowering its transaction costs. This matching of the difficulties of co-management in heterogeneous social-economic contexts is made possible by exogenously provided CSR funds that are mobilized by the third sector organization. Together with the openness of the state in that regard, we consider this the crucial factor making co-management come about. It leads to the creation of a shared understanding and the recognition of the need for exchange of resources.

Table 4: Table summarising the influence of legitimacy, shared understanding and exchange of resources on co-management across the three cases

Variables	Indicators	Measures	Urban Lake	Peri-urban Lake	Rural Lake
Legitimacy	Institutional Landscape	Structures that cater for participation of state and non-state actors in the process of co-management	Formal participations structures provided by the 74 th Constitutional Amendment and MoU between actor groups are practiced as a result of UwB involvement	Formal structures provided by the 73 rd Constitutional amendment are practiced within administrative boundaries	Formal participatory structures provided by the 73 rd Constitutional amendment are practiced in context of Gram Sabha

Shared Understanding	Common Problem Definition	Realignment of actor goals	A common definition is created as a result of the engagement of a third-sector organisation promoting community participation of community and exchange with state agents	Heterogeneous values and perceptions regarding lake management with no common definition for lake management	Community led realignment as a result of better information with introduction of a liaison officer for state engagement
	Process of Deliberation	Mutual communication and reflecting of preferences and values	Detailed in the MoU signed between actor groups leading to overcoming state scepticism	No mutual communication between and within actor groups	Exchange leads to community coherence, informed engagement with state and overcoming state scepticism
Exchange of Resources	Recognition of dependence	Salience (Personal and Social salience)	Social salience recognized by the community as a result of UwB engagement	No perception of salience by actors	Personal and social salience due to dependence on the lake
		Efficacy (Personal and Political efficacy)	Recognition of political salience of community involvement recognized by officials as a result of UwB engagement	No perception of efficacy by actors	Personal efficacy as community feels it can make a difference

		Pooling of resources	Pooling of resources by securing financial support from corporates and knowledge sharing facilitated by UwB	No pooling of resources	Pooling of knowledge by community and state
Mode of Co-management			Co-management led by UwB on behalf of the state	No co-management	Co-management initiated by the community based on dependence on the lake

In contrast, in the rural community, co-management is triggered by salience to the community and the underlying realization that community and the state interdepend in relation to lake management (exchange of resources). In a farming community water management is of core importance making it personally salient because it is decisive for individual livelihoods. Further, in the relatively homogenous socio-economic context the rural case investigated community benefits to add social salience. Thus, over time, water management for agriculture as well as water quality issues become important to an extent that the community invests into developing coherent and better-informed positions vis-à-vis the state. This in turn leads to better aligned perspectives internally and better exchange with state authorities developing shared understanding (aligned incentives) through processes of deliberation. This makes state authorities come on board and better cooperate with the community and better align its preferences. The expected benefits of co-management trigger the community to invest in this case.

Finally, in the peri-urban case development of co-management is riddled with several obstacles. The socio-economic context is heterogeneous in several ways, making cooperation within the community difficult. In fact, for new users it becomes personally salient to not engage in co-management but to defend the status quo of extensive water provisioning. The extent to which co-management compromises livelihoods for traditional users could not be

established but gaps in perspectives between new and traditional users seem to be unsurmountable. Further, stakeholders to co-management in the peri-urban case seem to be unclear as much as responsibilities of public actors are not clear. This leads to a lack of commitment among public actors to engage and it makes effective co-management even more difficult because of increasing transaction costs.

Altogether, these findings confirm that it is diverse context conditions that explain the pathways that lead to differences in co-management (Armitage et al. 2008; Husain and Bhattacharya 2004). Although more detailed reconstruction of cases leads to a kind of sequential argument about the relevance of the three variables of shared understanding, exchange of resources and legitimacy, we found that all three are vital for co-management to emerge. Further, although we measured different things for these variables, we found that they still largely condition each other. Thus, we conclude by proposing legitimacy, shared understanding and exchange of resources in the way we operationalized them are three necessary and together are also sufficient conditions for active and direct contributions by all actors to lake management.

Finally, the setting seems to play an outstanding role for the emergence of co-management or its failure more in general. Heterogeneity of the community affects preferences of its members and found to be of overriding relevance. It affects co-management in two ways. First, it affects social salience as actors will only engage into creating benefits for the community if they cherish it, we expect. Second, it affects transaction costs of coming to an agreement on the position and engagement of a community. Thus, costs of co-management significantly rise if the socio-economic context is heterogeneous, we expect based on the urban and peri-urban case. Ray and Bhattacharya (2011) also highlight that heterogeneity increases transactions costs by lowering costs of cooperation. If the community was left to its own devices and incentives to improve the situation were insufficient, co-management will not result. Finally, this intricate relationship between costs and benefits of co-management is context dependent also in relation to how contextual factors shape perceptions of livelihood threats that emerge from its absence. These seem to be side-lined in the peri-urban case. Correspondingly, lack of understanding of the local ecology and threats to livelihoods lead new users in the peri-urban case to discard co-management.

In what follows we want to further reflect on the relevance of the variables we investigate in relation to the literature and the particular Indian context.

Shared understanding among the actors as to why and how their participation matters is key for active contribution by actors across all three cases as indicated by Mees et al. (2018). The diverse perceptions of the lake have led to differing definitions of problems associated with the lake. As exemplified by our peri-urban case, each community is driven by lack of awareness and self-interest do not engage with each other (cf. Sharp 2012). In the peri-urban case this is amplified by a lack of deliberation process increasing scepticism between not just state and community but within the community as well (cf. Clark et al. 2013). In contrast, information gathering by community in the rural case created awareness and helped develop a common appreciation among all actors concerning the importance of the lake and decreasing scepticism as indicated by Thieken et al. (2007) which realigned community and state perceptions as also documented by, Sharp (2012) and Bohensky et al. (2010). In the urban case, increasing direct participation among actors overcame state and community scepticisms leading to shared understanding. This has led to the development of a collective identity as identified by Mosimane et al (2012) and reduced the transactions costs for co-management.

The institutional landscape providing structures of legitimacy through community participation is enshrined in the Indian Constitution, in the form of local self-governance but the quality of its implementation varies across the cases. In accordance with Rajashejkar et al. (2018), we attribute lack of community participation in urban case to a lack of active ward committees. Further, we observed that initial lack of interest among communities in our urban and peri-urban cases is fuelled by evidence of deterioration of lakes, which has undermined communities' willingness to participate and decreased trust in the state, as highlighted in the study by Fjeldstad (2004). Lack of information and knowledge about lakes and their role in the urban fabric among urban and peri-urban communities and the responsible agencies increased communities' transaction costs of engagement, which could only be overcome in the urban case, given the availability of CSR funding.

The realization of the need for exchange of resources between actors is crucial in co-management, as indicated by Stoker (1995). Actors across cases tend to collaborate with those who have access to resources, they do not possess. The urban and the rural cases highlight the mutual dependence between state and community in terms of knowledge and financial support. The state as the custodian of the lakes is a crucial actor. Thus, as indicated by several scholars such as Pomeroy and Berkes (1997), Sharp (2012) and Clark et al. (2013) overcoming state scepticism is key for co-management, which has been achieved in both rural and urban cases.

In contrast, there is no recognition of dependence in our peri-urban case as actors distrust each other because of increasing heterogeneity and lack of personal efficacy.

3.6 Conclusions

In this paper, we present an exploratory assessment of co-management in three cases situated along diverse contexts of urbanisation. We compared them on an analytical level with the aim to understand the relevance of three variables for emergence and functioning of co-management. Though the cases are not strictly comparable, based on qualitative evidence we found heterogeneity of the socio-economic setting and salience emerge as important aspects influencing co-management across cases. The role of the community in co-management is seen to vary with increasing heterogeneity of communities. Greater state involvement is required to facilitate co-management, in urban areas as communities become heterogeneous. We identify a homogenous rural community, who depended on the lake, directly engaging with state actors whereas the development of shared understanding had to be facilitated by an NGO in the heterogeneous urban community. Further, we find that actors engage with each other based on the importance they associate with the lake, which is captured by salience. Contextual factors which determine the possibilities of alternative livelihoods greatly matter here. This highlights the combined importance of socio-economic heterogeneity (high in urban case, low in rural case) and personal salience (low in urban case and high in rural case) for co-management. These findings are confirmed by the contrasting peri-urban case. Here salience (both personal and social) is relatively low and socio-economic heterogeneity high, which, in the absence of shared understanding leads to the absence of co- management.

As limitations of the study, we need to acknowledge that we look at a highly restricted set of explanatory variables in this paper. Each of the variables considered is multi-faceted and is dependent on numerous social, political and economic factors, which are beyond this paper. Further, we focus only on those actors who are active and directly involved in lake management overlooking others and providing just a snapshot of the actual realities on ground. Also, we did not address the environmental effects of co-management on the setting and the actors themselves.

Our results indicate that none of the three variables are individually a sufficient condition for facilitating co-management in the region but, all three are necessary together. The presence of structures for participation, though very important, do not ensure participation, actors need to realise the importance of their participation to ensure co-management. Further, we highlight

that although the reasons for engagement differ across cases, a shared understanding along with a process of deliberation among actors is crucial for co-management to be present. An understanding that lakes have a societal impact in addition to personal benefits augments dependence among actors. Third-sector organisations are crucial in organising a heterogeneous community around a common problem definition and facilitate state engagement. This leads to institution building by developing both vertical and horizontal linkages between and within actor groups as is seen in the urban case. We conclude this study of three illustrative cases by indicating that there is a need to expand the study of the relevance of the three variables investigated in this study for example, addressing medium-level of n and using different methodologies such as qualitative comparative analysis to understand co-management.

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4. Chapter 4: Bridging actors and their role in co-managing lakes: Cases from Greater Bengaluru Metropolitan Region (GBMR)

Abstract

Co-management is seen as a means to effectively manage common pool resources, especially collaborations based on sharing of roles and responsibilities between state and non-state actors. Collaborations depend on certain key intermediary bridging actors who facilitate and coordinate links between these actors. In this paper, we aim to understand the role of these bridging actors in shaping networks of co-management by developing a framework based on certain characteristics such as initiation, position, and facilitation of interactions whose application we illustrate for three lakes situated across a rural-urban gradient in Greater Bengaluru Metropolitan Region (GBMR). Drawing on concepts from co-management and social network analysis, we analyse data collected from documents, key informant interviews and FGDs to identify that bridging actors play a critical role in resource gathering, enhancing mutual trust and promoting innovation through information exchange irrespective of the social-ecological context. Beyond mere description, we highlight that state sponsorship plays an important role in establishment of bridging actors in urban and peri-urban areas due to heterogeneity in perceptions, actors, lack of trust and credibility in comparison to rural lakes where state sponsorship is less important and community engagement is stronger. We conclude that irrespective of the context, position of bridging actors plays an important role in facilitation of interactions within networks.

Keywords: Bridging actors, Co-management, Social Networks, Natural Resource Governance; Lakes, Rural-Urban Gradient, Bengaluru

4.1 Introduction

There is a consensus among researchers that urbanisation is one of the key drivers of environmental change not just at the local level but also globally [1]. This urban transformation of society is led by changes in land-use and associated administrative boundaries in accordance to societal dynamics rather than local ecology [1]. There is an increasing acceptance of the concept of *social-ecological systems* within urban ecology literature, whereby most studies focus on land-use patterns and their effects on ecosystem services and very few focus on management of common property resources engulfed by urban expansion [2,3]. There is a limited number of studies that consider interactions between human societies and local urban ecosystem, focusing mainly on “how diverse stakeholders contribute to collaborative management processes especially with regard to small-scale resource management” [4]. In this

paper, we set out to understand to understand how various actors collaborate to address issues of lake management across a rural-urban gradient within the Greater Bengaluru Metropolitan Region (GBMR) in India. In this paper, we focus on the role of bridging actors engaged in the formation and strengthening of collaboration networks, thereby contributing to the growing literature on how networks shape and are shaped by ecological contexts especially in view of urban transformations by identifying cases along a rural-urban gradient. Further, we augment the limited but growing literature on bridging actors by describing their roles as agents who promote and develop networks to manage small-scale natural resources in countries of the Global South.

In the Indian context, commons, in particular water, play a crucial role in ensuring local ecosystems and livelihoods of users [5] in both urban and rural areas [6,7]. Most of the commons are governed by the state, under public trust doctrine, and are formally vested within the revenue department [5]. The authority to manage commons are shared among various government departments, with local administration (city administration in urban and Gram panchayats⁸ in rural areas) responsible for managing them [5,6] (Personal interview Aphn 2019; personal interview Bal 2019). In addition, several policies and agencies provide resources – both human and financial- and are responsible for the management of public commons, specifically lakes. For example, the minor irrigation department funds activities, such as ensuring inflow and outflow of water, while the fisheries department is responsible for fishing rights within lakes. Further, there are local communities and residents, direct and indirect users, non-governmental and community-based organisations, and private companies who play active roles in the management of commons, such as lakes, in their neighbourhoods. This mosaic of actors and institutions, coupled with issues in differences in administrative and ecological boundaries [8], has created diverse values, perceptions, and knowledge among actor groups [9]. This diversity is mainly attributed to differences in “practices, interests, values and management structures” [10]. To overcome this diversity of information sources, government and non-government actors have invested in building networks, which link diverse knowledge systems necessitating the role of coordinators and facilitators to ensure collaboration between actors involved in managing the commons [10].

In this paper, we illustrate a framework describing the role of these coordinators and facilitators, or bridging actors, within networks in three cases along a rural-urban gradient and describing how these actors shape networks involved in co-management of lakes in GBMR. Ultimately, this allows us to make indications as regards how social-ecological contexts and particularly socio-economic heterogeneity affect the role of the state and communities for the emergence of bridging actors. The paper is structured as follows: in section 2 we develop a framework for characterizing bridging actors based on various typologies developed within the conceptual framework. Subsequently, in section 3 we illustrate the application of the framework describing the case study area and the methodology used to analyse the results. Section 4 summarises the analysis of individual cases and results. Section 5 details the discussion and comparison across a rural-urban gradient leading to indications of how social-ecological context affects the emergence and role of bridging actors vis-à-vis the state. It is followed by the conclusion.

⁸ Gram Panchayats are the local self-government organisation at the village level in India

4.2 Co-management and Bridging actors

Co-management is recognized as an alternative to conventional management of resources [4]. The understanding of co-management as a collaboration between the state and the resource users as considered in the literature does not hold true in real-life situations [11]. The state cannot be considered as a single coherent actor, as its authority varies vertically and horizontally, with individual state organisations possessing diverse aims and interests. The same applies to the users, who have different positions driven by self-interests [11]. Thus, co-management requires development of coherent networks between multiple actors from different areas of society [12,13] based on sharing of power [4,14], resource dependence based on formal jurisdictions as well as rules and norms that govern the actual condition of exchange [11,14]. In the face of uncertainty and transformation, the capacity to create and prioritise whom you collaborate with and how you collaborate has an impact on the outcome [15]. These collaborations depend on development and sustenance of social relations in networks, mainly between actors across levels who often possess specific information and resources [3,16]. The structural patterns of the collaborative relationship shaping the outcomes differ based on the “role of central actors and bridging ties that enable collective action among previously unconnected actors” (Bodin and Crona [17]; as quoted in Lee and Krasny [4]). This act of bridging ties by actors is a critical element necessary for the success of co-management [18]. Several scholars have indicated the need for intermediary bridging actors, both individuals and organisations, who act as facilitators and coordinators, linking diverse actors [16,19] through a process of bridging [9]. Brown [20] describes bridging actors as organisations linking actors across sectors to tackle problems that individual actors are unable to solve by themselves, thus defining bridging actors as “*a conduit of ideas and innovations, a source of information, a broker of resources, a negotiator of deals, a conceptualiser of strategies [and] a mediator of conflicts*” (Brown as quoted in Crona and Parker [21]). In our paper, we use this definition of bridging actors to identify actors (both organisations and individuals) who facilitate collaboration between diverse actors across levels, thereby enhancing their capacity by increasing social capital through trust building among the networking actors [22,23].

Scholars such as Schultz [24], Olsson et al. [16], Hahn et al. [25] and Newman and Dale [26] highlight the importance of bridging actors, where they strengthen the capacity of all actors involved in the network to adapt to change. Scholars have highlighted that bridging actors play a crucial role within a network, as they can facilitate or block the flow of information and resources [4,27,28]. Crona and Hubacek [27] and Prell et al. [28] - looking at social networks - highlight that bridging actors influence flow of information and resources, enabling interactions and building social capital and trust among actors. Bridging actors can be seen as agents who build trust and enhance learning leading to vertical and horizontal collaborations [25]. The literature on urban regimes indicates that for a “governing coalition”, i.e., collaborative networks, to be effective, there is a need to bring together adequate resources by identifying and working with actors who possess the right resources [29]. Literature on resource exchange highlights that organisations collaborate with others to access resources that are insufficiently available to them, prompting them to identify and collaborate with other actors to achieve their goals [30]. Thus, actors create connections and networks augmenting their access to financial, legal and political resources. Berardo [30] highlights that a network performs successfully when a bridge is created between resource rich actors with those in need of resources. This can be achieved by building connections between disconnected actors through brokers (bridging actors) who are positioned to impact the flow of resources within a

network [30,31]. Several scholars studying networks of natural resource governance have highlighted various roles of bridging actors including cross-scale bridging [3,10], within and across-type bridging [32,33] and bridging positions to reduce fragmentation [34]. Based on these various specific and general divisions of bridging activities we identify initiation, position, and facilitation of interactions as three main characteristics of bridging actors, which we consider to have an influence on their roles within networks managing natural resources (summarised in Table 1).

4.2.1 Characteristics of bridging actors

Initiation of a bridging actor is an important characteristic, and the literature indicates numerous reasons for the establishment of collaborative networks [35,36]. Agranoff and McGuire [29] and Imperial [36] highlight that state actors facilitate the conditions and emergence of collaborative networks where state actors help in development, share the financial burden and increase the likelihood of delivering goods and services. Imperial [36] stress that networks can be initiated based on a shared understanding between actors to identify solutions to a common problem and provide a service. Rathwell and Peterson [10] underline that both governments and non-government actors have invested in building networks with an aim to improve coordination leading to the establishment of bridging actors who create, support and maintain networks [37]. Sayles and Baggio [15] indicate that collaborations between actors based on shared interests are more productive than when they are mandated.

The position of bridging actors plays a crucial role in enabling collective action among actors within and across networks. It is an important factor as information exchange is a key characteristic of bridging actors. They are seen as key actors capable of extending information across scales and promoting mutual preferences and shared understanding among diverse actor groups. Therefore, they are also referred to as ‘knowledge brokers’ [38]. The position of bridging actors not only helps in information exchange and building alliances within the network [11,38] but it also leads to development of common perceptions based on a common understanding of the problem [38]. Berkes [39] highlight that bridging organisations enable connections between disconnected actors with differing interests, lack of resources or mandate to work with each other by facilitating coordination for consistent management. Angst et al. [34] define two main positions based on bridging activities, periphery connectors, who connect disconnected actors to the core of the network and central coordinators, who facilitate action as they “connect a great number of actors” within a network. Central coordinators create the shortest path between actors enabling quick and easy dissemination of information between actors [34]. Periphery connectors help access new knowledge leading to information heterogeneity, enhanced effectiveness and adaptability in natural resource management [11,34].

Facilitation of interactions between actors is one of the key characteristics of bridging actors as they connect actors across levels who might otherwise be disconnected [21,40]. McAllister et al. [41] opine that there are individual payoffs to actors which steer actor interactions. Network theorists differentiate between bonding and bridging capital, which can impede or encourage interactions between actors within networks to identify solutions [42]. Bonding capital promotes development of shared understanding between actors based on trust, thereby overcoming scepticism leading to the development of “close-knit” groups [43]. This limits actors’ access to new information, resulting in homophily as all the stakeholders have a shared understanding and expectations [43]. Bridging capital involves development of interactions

between actors who are disconnected leading to the acquisition of new information from varied actors ensuring heterophily [44], as there is no overlap of information in these network structures [42].

Applying the above understanding of bridging actors and their characteristics summarised in Table 5, we identify bridging actors (organisations and individuals) and to understand how these actors shape networks involved in co-management of lakes. Further, we aim to understand how the local socio-ecological contexts shape the roles of bridging actors along three lakes situated across a rural-urban gradient in GBMR.

Table 5: Characteristics of bridging actors as described in this paper

Characteristics of Bridging Actors	Categories	Description
Initiation	State sponsored (top-down)	Initiated to reduce financial burden and increase the likelihood of delivery of services
	Self-organised (bottom-up)	Initiated to gather information, build trust, credibility, and act towards common goals
Position	Central Coordinator	Central coordinators create the shortest path between actors enabling information dissemination
	Periphery Connector	Periphery connectors connect otherwise disconnected actors providing access to new knowledge
Facilitation of Interactions	Bonding capital	Bonding capital refers to development of shared understanding between actors by building trust and overcoming scepticism
	Bridging capital	Bridging capital refers to access to new information based on interactions created with actors who are not connected leading to innovation

4.3 Materials and Methods

Our study was conducted in three lakes along a rural-urban gradient within a single watershed boundary in the Greater Bengaluru Metropolitan Region (GBMR). Bengaluru, with a population of 12.7 million [45], is undergoing rapid development and associated transformations, negatively impacting its local natural resources and ecosystems [1,46]. The region relied on water from reservoirs created by damming small streams, which were managed by designated communities and individuals from local villages, who were responsible for

maintaining bunds, clearing silt and regulating flow from lakes to store rainwater and provide for water needs throughout the year [1,6]. In this paper we use a contrasting case study design [47], selecting three cases, embedded within a single watershed (Vrishabavathi river), refer Figure 6. The lakes are nourished by continuous wastewater flows originating in the city and flowing outwards carrying nearly 50% of urban wastewater, leading to continued practice of agriculture in peri-urban and rural areas, creating a rural-urban gradient in Southwestern Bengaluru. Though present within a single watershed, the selected lakes were identified to cover diverse urban, peri-urban and rural land use patterns with differing dominant livelihoods, societal and state actors, administrative boundaries, ecosystem services. This allows us to identify how actors in different socio-ecological contexts create collaborative networks to address issues of lake management within a single watershed. This case design provides us with an opportunity to compare cases across a gradient, analysing how core dimensions of urbanisation such as urban land use, encroachment, dumping of industrial and domestic wastes, and changes in institutions affect lake management at the local level in GBMR. Further, there is limited studies focusing mainly on urban lake management, providing us with an opportunity to assess and compare the role of bridging actors in the formation of networks involved in lake management in urban and non-urban areas within GBMR.

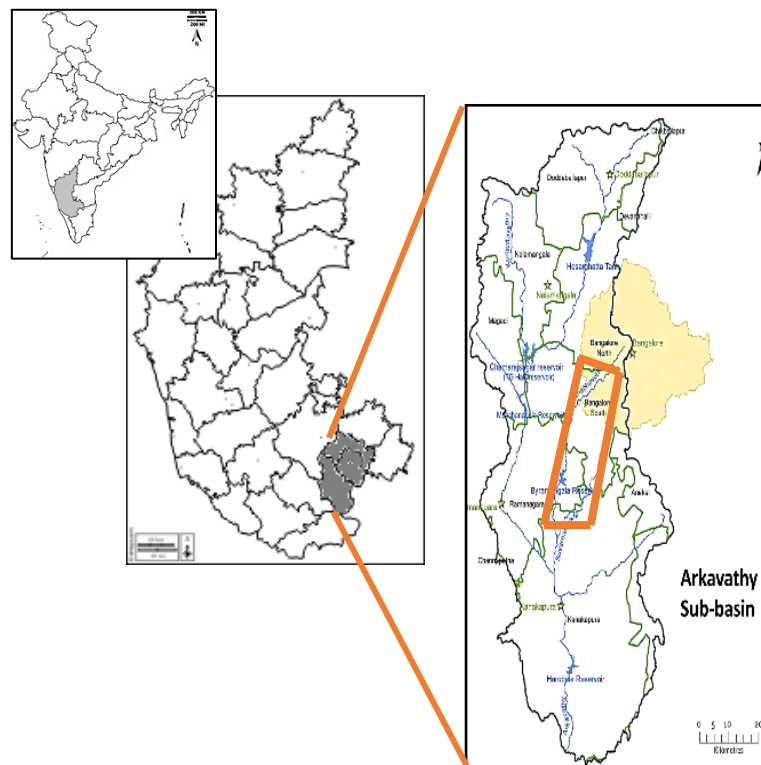


Figure 5: Figure highlighting GBMR (in Grey) and the case lakes (within the orange box). Modified from Lele et al. [48]

4.3.1 Methodological framework

In this paper we use social network analysis, drawing insights from qualitative network analysis as posited by Ahrens [49]. Below we provide a brief overview of why we employ social network analysis against alternative approaches, the steps taken in identifying respondents, interview questions and how we operationalise this data based on network parameters.

We use social network analysis to study the role of bridging actors within networks of actors involved in lake management. We use social networks as they are better suited to study the behaviour of an individual actor at the micro-level in addition to the structure of connections between actors in the form of network structure at the macro-level [50]., In contrast to the conventional approaches which focus on actors and their attributes, social networks emphasise on actors described by their relation to others [51]. Social network analysis has been used to study the characteristics of social networks in enabling collective action leading to successful management of natural resources [4,52–54]. In this paper, we focus on understanding the role of bridging actors in enabling co-management, which, as described in the conceptual framework, requires development of coherent networks highlighting the importance of relations between actors. Hence, we choose to use social network analysis instead of other conventional methods to identify the role, influence, and position of bridging actors in the facilitation of interactions within networks to enable co-management.

Qualitative data for the analysis was collected based on key informant interviews and focus group discussions conducted in 2018-2019. This data has not been corroborated with quantitative network data, as quantitative data could not be collected due to pandemic restrictions. Purposive sampling was undertaken to identify respondents, who were classified into state and non-state actors. Participants were considered as representatives of their organizations. State actors responsible for lake management were identified through document analysis, based on assigned responsibilities for lake management. Non-state actors were identified using a two-pronged approach of screening media articles (social and print media) on the selected case lakes, followed by visits to the lake and identifying users and key informants working towards lake management. The identified actors were further classified based on Stein et al. [55]: first on their influence, where we distinguish between direct and indirect influence. Direct influence indicates that “an actor directly uses water or modifies its flow through modification and control measures,” while indirect influence indicates that “an actor through their activities influences other actors to modify land, water, or vegetation” [55] (p 1088). Second is a relational criterion focusing on regular interactions between actors. This classification reduced the number of actors to a small set who regularly and actively interact with each other. Though there are numerous state organizations that are responsible for lake management, respondents (direct influencers – users and state custodians) indicated that they rarely interact with other state actors, thus narrowing down the actors to three main groups: users (community residing around the lake), state custodians (directly responsible state agencies) and third-sector organizations.

During the interviews the respondents were asked who they collaborate with for lake management and their reasons for collaboration? Collaboration was defined to include repeated exchange of information, knowledge gathering, and provision of resources, both financial and human. We also inquired if the collaboration was based on official mandates requiring actors to interact with each other leading to joint planning and management. Network data was derived from interviews, mainly based on the presence or absence of information and knowledge exchange (present = 1; not present = 0); resource support (support provided = 1; not provided = 0) and whether the collaboration was mandated or not mandated (mandated = 1; not mandated = 0) between actors. These binary codes were organized into adjacency matrices and analysed using the software UCINET [56].

4.3.2 Operationalisation of network data

Qualitative data obtained by interviews was operationalized based on the network measures of density, centrality, and core-periphery analysis to identify bridging actors (summarized in Table 6). The data was further used to identify how bridging actors were initiated. To analyse the position of the bridging actors, we undertake the core-periphery analysis to identify the core and peripheral actors, within each network. As the networks are small, this analysis leads to identify the key central and peripheral actors as well as the bridging actors who connect these otherwise disconnected actor groups. Further, we use a centrality measure of *betweenness centrality* to identify central coordinators as suggested by Angst et al. [34]. The betweenness centrality refers to the number of times an actor rests between two others who are themselves disconnected [57–59]. Angst et al. [34] indicate that betweenness centrality measures the shortest path between any two actors, defining it as the “minimal number of connections that an actor needs to reach another actor.” High betweenness centrality performs the role of broker, or act as a bridge, who bring together “disconnected segments of the network” [57] (p 504). They might have to take sides during a conflict, which can be disadvantageous. Following the method outlined in Angst et al. [34], betweenness scores were analysed based on an actor’s position taking into account cross-connections between all actors that an actor is connected to.

We then use the measures of density and centrality to identify bonding and bridging capital. The strength of a collaboration is reflected in the density or strength of a tie between the collaborating actors. The stronger the tie, the greater is the influence among actors, and can lead to sharing of information, higher trust, mutual learning and support [57,60] but also to information redundancy as compared to weak ties, characterised by less frequent communication. Prell et al. [57] distinguish two kinds of centrality when considering resources management: betweenness and degree centrality. The former is used as a measure of the bridging capital and refers to the “number of times an actor rests between two others who are themselves disconnected” [57–59]. Whereas the latter is used to measure bonding capital of bridging actors, indicating the number of actors directly connected to other actors. Actors with high *degree centrality* are considered important players, who can bring actors together. These actors possess weak ties, as they must maintain ties with numerous actors within the network compared to others. Actors with high degree centrality can use their links to share information, but this does not guarantee that they can also influence other actors.

Table 6: Network measures used for the analysis of the role of bridging actors in lake management (Adapted from Prell et al. [52], Enqvist et al. [61], Bodin et al. [62], Ernstson et al. [3], Fliervoet et al. [63])

Network Characteristics	Description	Measures
Density	The number of realized ties in the network as a measure of the extent to which all actors in the networks are tied to each other (Wasserman and Faust 1994)	High density increases trust between actors, thus increasing possibility for social cohesion and reduces the cost of collaboration which is essential for collective action

		<p>It can also lead to increased dissemination of information and exchange of resources</p> <p>Can lead to homogenization of knowledge</p> <p>High reachability indicates the presence of higher channels for information sharing between actors leading to enhanced social cohesion and development of shared understanding</p>
Reachability	Indicates the number of steps needed to reach from one node to another	
		<p>Higher degree centrality facilitates information sharing between actors leading to shared understanding</p> <p>Actors with contacts to many others can be targeted for motivating the network and diffusing information fast through the network, i.e., these are the focal actors in a centralized network</p> <p>High degree centrality can lead to centralising decision-making to a few central actors and reduce the access to diverse sources of information to individual actors</p>
Degree Centrality	Indicates the number of links for every node, central actors have a higher number of ties to other actors within the network (Wasserman and Faust 1994/2009)	
		<p>Indicates the role of ‘actors in the middle’ (actors that lie in between other actors), who have some control over reachability in the network (Wasserman and Faust 2009, pg. 188)</p> <p>Large betweenness centrality indicates that an actor must be between many actors within the network highlighting its central role in ensuring exchange of resources and information sharing</p>
Betweenness Centrality		

These actors can help link otherwise isolated actor/groups

Can lead to assimilation of distinct knowledge systems located among various actors

4.4 Results

The resulting social network map of the case lakes located along the rural-urban gradient highlights the presence of two distinct unconnected network clusters. This can be attributed and delineated based on the administrative boundaries of urban Bengaluru. The networks are termed urban and non-urban cluster (Figure 6). The non-urban cluster can be further divided into peri-urban and rural clusters, with rural cluster being relatively well-connected compared to the peri-urban cluster. Below we describe the two network clusters separately, as we see a distinct separation between the two networks. We consider the role of bridging actors when present in enabling collaborations between actors involved in lake management in GBMR.

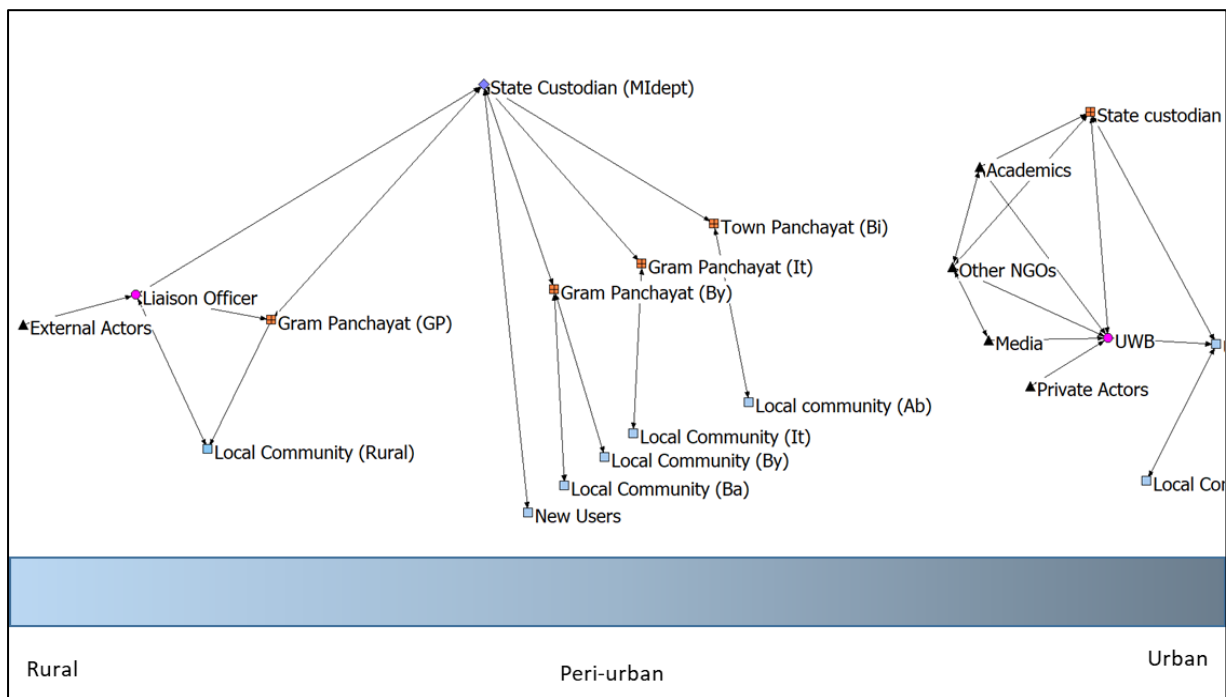


Figure 6: Network Map indicating the social network among actors across lakes along the rural-urban gradient in GBMR

4.4.1 Urban network cluster

The lake was once a main source of irrigation for the village and has undergone changes in its governance since the lake was built in 1896. There have been numerous proposals on converting the lake into an open space with tree parks by various committees examining the feasibility of preserving the lake. There has been a change in the ecosystem services derived

from the lake, namely from provisioning services to a more social and cultural services with urban transformation. The lake area was protected from encroachment by the fencing of the boundary by the Karnataka Forest Department in 1994 (Personal interview, mmuw 2019). The custody of the lake has changed several times and is now under the city administration, i.e., the Bruhat Bengaluru Mahanagara Palike (BBMP), which restored it in 2010 and invited a third-sector organisation to help in carrying out the day-to-day activities of lake management. The main actors involved in lake management are the city administration (BBMP – state actor), third-sector organisation (United Way Bengaluru – UWB) and the resident community (users).

An analysis of the urban network highlights the prominence of UWB, within the network (Figures 7a and 7b). The core-periphery analysis of the network identifies UWB, UMNV (local community association) and the state custodian (BBMP) as the core actors which also represent the close-knit group of actors with strong ties. The density of the urban network is 0.607, indicating that only half the network is directly connected to each other. The network is highly heterogeneous (0.922), highlighting the presence of diverse actors, who are connected through UWB, which has high betweenness and degree centrality values (Figures 7a and 7b, refer Table 7 for centrality measures), indicating its role as bridging actor. Below we describe the three characteristics of how initiation, facilitation, and position of UWB (bridging actor) shape urban lake management.

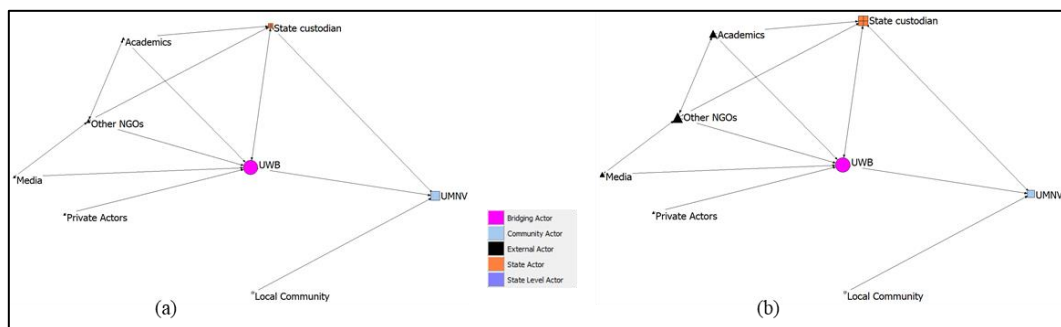


Figure 7: Figures highlighting the networks for lake management in urban case. (a) depicts the betweenness centrality and (b) degree centrality for actors within the network. (Size of the node indicates a higher centrality value)

Table 7: Centrality measures for the urban network (analysed using UCINET)

Actor Name	Actor Attribute	Degree Centrality	Betweenness Centrality
State Custodian (BBMP)	State Actor	0.333	2.880
Third-Sector Organisation (UWB)	Bridging Actor	0.476	16.640
Local Community Association (UMNV)	Community Actor	0.286	8.320
Local Community	Community Actor	0.048	0
Media	External Actor	0.095	0

Academics	External Actor	0.143	0
Private Actors	External Actor	0.048	0

We identify a top-down initiation of the bridging actor, as the state custodian (BBMP) approached UWB to secure funding and undertake day-to-day lake management and signed a memorandum of understanding outlining specific roles and responsibilities. UWB did not have any local presence in the area and had to work with a heterogeneous community belonging to different socio-cultural and economic backgrounds and having varied perspectives of the lake (Personal interview mmuw 2019). UWB undertook numerous outreach and community building activities with the help of certain interested community members and local elected representatives. This led to the creation of local community association named, Uttarahalli Moggekere Nadigedarara Vedike (UMNV), which was made signatory to a tri-partite agreement between state custodian and UWB. Thus, even the local community association was developed in a top-down manner and involved in lake management.

UWB helps facilitate interactions, building both bonding and bridging capital within the network. UWB facilitated the development of a group of close-knit actors working towards lake management based on a shared understanding of the issues that need to be resolved. This was possible with the organisation of a heterogeneous community and setting up of UMNV, as well as making them a signatory to the tri-partite agreement detailing individual roles and responsibilities. Thus, UWB was able to facilitate bonding capital between the state and community by building trust and overcoming scepticism that was existing between them. This close-knit group of actors are connected to external actors (academics, media houses, other NGOs and community groups in addition to private actors) through UWB, to gather information and funding. Thus, UWB facilitates interactions between previously disconnected actors enhancing the bridging capital by providing access to new information and innovation in lake management.

UWB is positioned both as a periphery connector and a central coordinator as it helps to connect disconnected actors to ensure information and resource transfer as is mandated in the tri-partite agreement [64]. It is a well-known face within the small and growing network specialising in lake management in Bengaluru. This was clearly highlighted during the interview “UWB is an organisation reputed securing funds from private companies, under the corporate social responsibility policies, has prior experience in working with academics and other like-minded NGOs working on lake management in the city, which was also the reason for state authorities to collaborate” (Personal Interview mmuw 2019). Thus, it was easier for UWB to connect with external actors working on lake management to gather information and knowledge, acting as periphery connectors linking the close-knit group with the wider network involved in managing the lake. Figure 8 shows the high values of centrality of UWB indicating that it lies between other actors, creating the shortest paths between two actors within the network, and thereby ensuring its role as a central coordinator. Hence, UWB enables information and resource exchange based on assimilation of diverse knowledge located among various actors, further bolstering their shared understanding regarding lake management.

The urban network is highly centralised around UWB, which holds most ties within the network. Literature indicates that even though such centralisation is helpful during the formation of networks, it is highly unfavourable in long-term planning as it can lead to

dominance and control of the network by the centralised actors [57,60]. Though UWB has a high degree of centrality, the sharing of roles and responsibilities detailed in the tri-partite agreement ensures there is no centralisation of decision making by UWB.

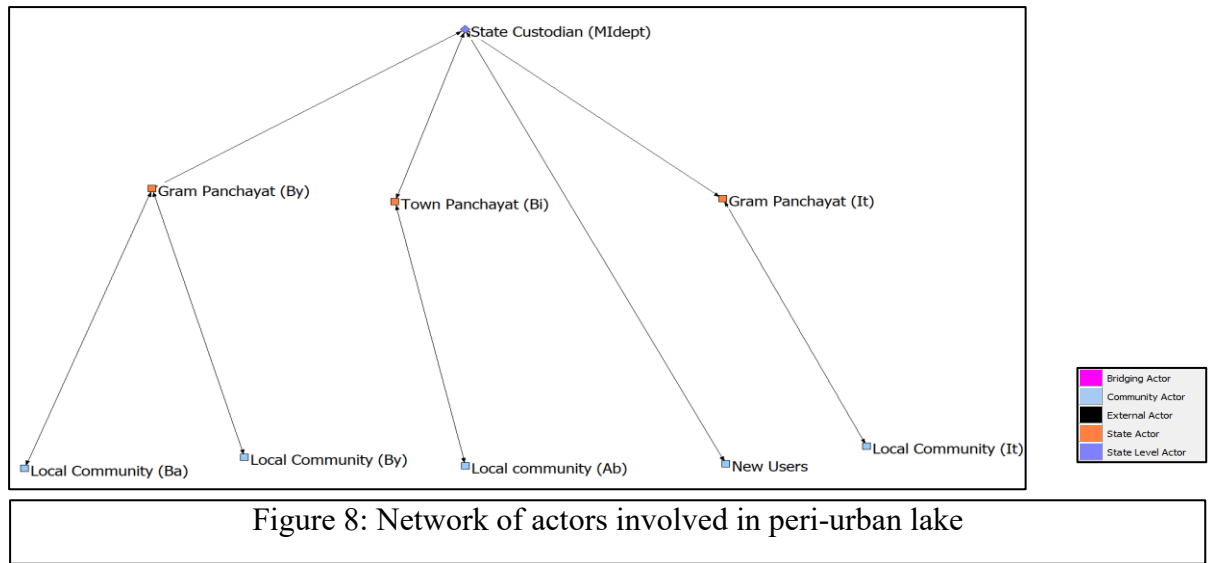
4.4.2 Non-urban network cluster (Peri-urban and Rural networks)

Looking at Figure 7, we can clearly distinguish two distinct networks connected by the state custodian, the Minor Irrigation department (MIdept) at the state level within the non-urban network cluster. We identify a hierarchical tree network in the peri-urban lake and a well-connected network in the rural lake, with no interactions between community actors. MIdept as the responsible actor for the lakes is mainly located at the state level with limited interactions at the local level of the lake. The peri-urban and rural lakes are managed by the MIdept separately, with limited interactions (Personal interview MDByr 2019). In the following, we look at the peri-urban and the rural networks as separate networks and first describe the peri-urban lake network followed by the rural lake network.

4.4.2.1 Peri-urban Lake network

The peri-urban lake, located downstream to the urban lake, is the recipient of the urban wastewater which has converted the lake into a perennial source of water. The lake is bound by four villages located under different administrative boundaries, with one of the villages being incorporated into the nearest town administration leading to the presence of diverse disconnected actors in the network (Figure 8). The network consists of mainly mandated vertical collaborations between users and state agencies through local administration (Gram Panchayat at village level and Town Panchayat). Thus, the local administration acts as a bridging actor between MIdept and users. It also plays the role of a central coordinator, mainly enhancing bridging capital between the actors through organisation of village meetings. There is no shared understanding among the users as new users are happy to receive water and want authorities to continue the same practices, whereas older users want the water-flow to be regulated and the quantity of water in the lake to be reduced (Personal interview Gpby, 2018), leading to fragmentation of the network. Further, there is no inter-GP coordination between the local administrations, as is reflected in the low density of the network (density value 0.113). There is also a lack of trust between actors as was pointed out by users during discussions “the officials come, tell us they are working on the lake, and they go away.” This is exacerbated by a lack of interaction between

MIdept and the users (Personal interview Gpby, 2018). Jurisdictional ambiguity and administrative overlap has reduced trust and reciprocity among users as indicated during FGD “Byr is now a different panchayat, they will get some things approved and they will eat up the money themselves.” The addition of new users, located up to 10 kilometres from the lake, with expansion of irrigation channels by MIdept to manage the water flow without deliberations with local communities has added to the complexities due to increasing actors in lake management. During discussions, users highlighted the hope that the state can do “something”, as they perceive themselves unable to manage the lake due to administrative overlaps in addition to the perceptions that they are “poor people with no power”. The need for a “bridging organisation which can connect across communities and state organisations to ensure information exchange and create a shared understanding” was also pointed out by both users and officials of local administration.



4.4.2.2 Rural Lake network

The rural lake, located downstream to the peri-urban lake is also a recipient of urban treated wastewater. This has led to the continued practice of agriculture in the village and brought economic benefits to the community. Though the user community has economically benefitted from the lake, they have had to adapt their cropping patterns and shift from traditionally grown crops to cash crops. Furthermore, the use of wastewater has also impacted the health of the soil. This led the users to identify alternate ways of conserving the lake while still having access to uninterrupted supply of water for agriculture. Thus, the main actors involved in lake management are the state custodian (MIdept), village administration (Gram panchayat) and the users.

The analysis of the rural network, highlights that the network is mainly composed of state actors (custodian (MIdept) and village administration) and users, indicating a low heterogeneity in terms of actors. External actors consisting of politicians (state and national levels) support the community in terms of knowledge transfer and legal support. We see the presence of a close-knit group consisting of state custodian (MIdept), GP, users, and a -liaison officer. The core-periphery analysis of the network highlights the prominence of the liaison officer and the Gram panchayat (village administration) as crucial actors within the network (Figures 9a and 9b). The network is found to be highly dense with a value of 1, indicating a very high group cohesion. The liaison officer has high centrality values (betweenness and degree) whereas the GP has a high degree centrality (refer to Table 8 for centrality measures). There are strong ties between the state actors and between users and the GP, as they are mandated to collaborate to share information and resources required for lake management. Below we describe the three characteristics outlined in Table 1 to identify how initiation, facilitation, and position of bridging actors (GP and liaison officer) shape lake management.

The GP, a bridging actor was established by the state government under the 73rd constitutional Amendment followed by the Karnataka Panchayat Raj Act 1993 to promote local self-governance. The GP is mandated to facilitate interactions between users and state actors by providing a platform for regular village meetings highlighting a top-down initiation of this bridging actor. The users needed to gather more information to ensure deliberations at village

meetings leading to the identification and nomination of a liaison officer from among them to connect with MIdept and other state authorities mainly for information gathering. Hence, the liaison officer, who is another bridging actor, was initiated by a self-organised bottom-up approach to solve the information deficit by the community.

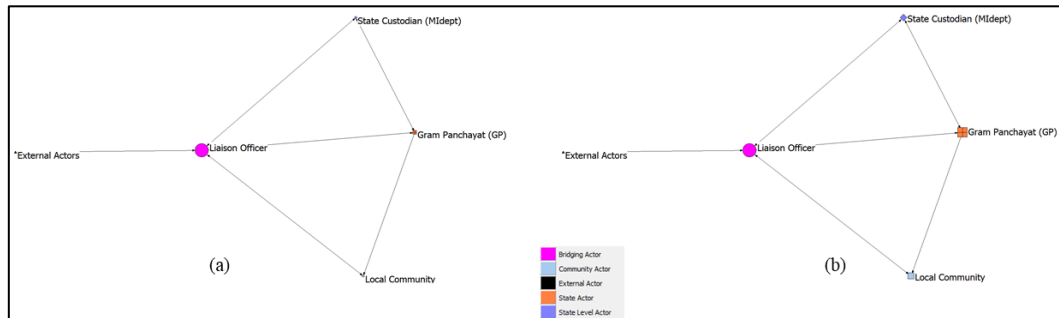


Figure 9: Figures highlighting the networks for lake management in rural case. (a) depicts the betweenness centrality and (b) degree centrality for actors within the network. (Size of the node indicates a higher centrality value)

Table 8: Centrality measures for the rural network (analysed using UCINET)

Actor Name	Actor Attribute	Degree Centrality	Betweenness Centrality
State Custodian (MIdept)	State Level Actor	0.250	0
Gram Panchayat (GP)	State Actor	0.500	0.40
Liaison Officer	Community Actor	0.417	6.80
Local Community	Community Actor	0.417	0

The liaison officer as a bridging actor helps in facilitating both bonding and bridging capital within the network. This is based on information exchanged between actors, enabling a shared understanding of the lake as an important source of livelihood of the village. As pointed out during discussions, users indicated that repeated interactions by liaison officer have led to improved trust and credibility of each other. The state officials now view the community as credible actors who are well-informed on state policies and regulations (Personal interview of Mi, 2018). In terms of facilitation, the liaison officer facilitates a bonding capital between state and users through information exchange and building credibility. In search of information - legal and policy related - regarding lake management, the liaison officer has connected with external actors, linking the close-knit group of actors with new information sources thus enhancing the bridging capital of the network. The GP, through the facilitation of the village meetings, provides a space for the development of shared understanding between state custodian (MIdept) and the users, facilitating bonding capital based on building trust and understanding.

The GP plays the role of a central coordinator within the network as it formally coordinates state-user interactions, mainly in the form of a deliberation platform, as is stipulated by law where users deliberate with state agencies. The liaison officer is also a central coordinator, creating the shortest path between actors by establishing connections with all actors within the network (Figures 5a and 5b), mainly to gather information based on the needs of the community. The liaison officer is also a periphery connector supporting information exchange between external actors and the close-knit group of users and state actors within the network (Figure 4). This has enabled mobilisation and diffusion of information among all actors, thereby providing a holistic view of lake management.

4.5 Discussions: Bridging actors and co-management of lakes across rural-urban gradient

Based on our analysis of networks in three lakes along the rural-urban gradient, we identify and describe actors who are the main source of information, broker of resources and negotiator of deals as bridging actors based on the definition adopted in this paper. These actors are crucial to the formation of networks shaping co-management of lakes along the rural-urban gradient. In accordance with Rathwell and Peterson [10], we indicate that bridging actors can be developed by both state (urban case) and non-state actors (rural case) based on contextual reasoning (summaries in Table 5). As is seen in our urban case, the state custodian approached a third-sector organisation (UWB) to secure resources and organise a heterogeneous community with low willingness to collaborate. Whereas in our rural case, the community nominated a liaison officer who connects state and non-state actors mainly through information exchange as required by the community. We briefly indicate a possible explanation below. In both rural and urban cases, we see the presence of a third-party (bridging organisation) who provides the bridging activity as indicated by Westley and Vredenburg [65].

We highlight that the socio-ecological contexts across the gradient influences the characteristics of bridging actors (refer Table 9). This is clearly identified in the process of initiation, as the bridging actor (UWB) in our urban case was approached by the state actor to share certain responsibilities and reduce the financial burden, whereas in the non-urban network cluster, the bridging actors were state mandated (GP – village administration) based on law. The need for information of the rural community to deliberate in meetings led them to self-organise and identify a liaison officer to aid them in collecting and disseminating information between the state and users. Thus, we can clearly indicate that resources (finance) and information gathering as well as exchange are the key reasons for the initiation of bridging actors in our urban and in rural cases respectively.

Table 9: Summarising the results of the characteristics of Bridging actors observed in urban and rural case

Location of the Lake	Bridging Actor	Characteristics of Bridging Actors		
		Initiation	Facilitation of Interactions	Position
Urban Lake	Third-Sector Organistaion (UWB)	Top-down (State sponsored)	Bonding and Bridging capital	Central coordinator and

				Periphery connector
Peri-urban Lake	Gram Panchayats (GPs)	Top-down (state sponsored)	Bonding capital	Central coordinator
	Gram Panchayat (GP)	Top-down (state sponsored)	Bonding capital	Central coordinator
Rural Lake	Liaison Officer	Bottom-up (self-organised)	Bonding and Bridging capital	Central coordinator and Periphery connector

As indicated by Crona and Parker [21], we highlight that even though the reasons for developing bridging actors differ for the urban and rural lakes, they have been successful in facilitating bonding capital within the networks by building credibility and trust, overcoming scepticisms and enabling information access and exchange through facilitation of bridging capital among actors enabling co-management. In our urban case, UWB organized a heterogeneous community based on a shared understanding leading to the development of a close-knit network between the bridging actor (UWB), users and the state, built based on shared understanding and mandated by the signing of the tri-partite agreement has facilitated bonding capital among actors built on trust and reciprocity. Further, UWB provides this close-knit network access to new sources of information and resources by facilitating connections between various external actors which are characterised by weak ties (Figure 2). This bridging capital makes it feasible for actors to support each other by identifying opportunities to generate innovative ideas for lake management, as these actors are located in different knowledge circles, thus having access to diverse information sources as indicated by Granovetter [66] and Olsson et al. [16]. This has led to information exchange enhancing credibility among actors as indicated by Bodin et al. [54], reducing the cost of collaboration. The liaison officer in the rural lake acts mainly as a ‘knowledge broker’, who, as indicated by Cvitanovic et al. [67], helps to develop community credibility with both state and external actors based on informed discussions. Further, informed deliberation between actors has promoted development of mutual preferences between and within actor groups, leading to collaborations between state and non-state actors based on shared understanding as indicated by Ernstson et al. [3], Olsson et al. [16] and Imperial [36]. This is in line with Crona and Parker [21] who highlight that access to information enables non-state actors to effectively interact with state actors. The liaison officer is connected to other actors within the network with weak ties (Figure 4), which helps in information access and exchange across actors leading to generation of new knowledge and opportunities as indicated by Granovetter [66].

Bridging actors in both urban and rural cases are positioned as periphery connectors enabling information exchange by connecting various disconnected actors within the network. They also act as central coordinators as they create the shortest path between any two actors ensuring easy diffusion of information, and thus can be defined as central coordinators and, as indicated by Prell et al. [28], enhance adaptive capacity of lake management. In our urban lake, the

bridging actor UWB is characterized as both a central coordinator and periphery connector as it creates the shortest path between actors in the network and connects the close-knit group of state and users with external actors. In the rural case, the liaison officer is positioned as both a periphery connector and a central coordinator connecting the community with external actors and creating the shortest path between actors (Figure 4). In contrast, the GP is positioned as a central coordinator enhancing state-user interactions by creating the shortest path between them within the rural network. We see the presence of two bridging actors in the rural case as against the urban case. This can be attributed to the establishment and the effective functioning of the decentralisation of local administration through involvement of residents in India pushed by the 73rd constitutional amendment in rural areas compared to the lack of establishment and inefficient functioning of the decentralized local self-government in urban Bengaluru (Personal interview, KC 2018).

We also indicate from the above network analysis that there is a higher diversity of actors in the urban networks, who have access to academics, other NGOs, and media actors to gather information, while the rural networks are more homogenous and mainly limited to state and community actors. This observation takes the analysis of case studies beyond mere description. The state actors in both rural and urban cases, mainly local governments (GP in our rural case and State custodian in urban case) do not themselves act as periphery connectors but they work with bridging actors who act as periphery connectors [34]. The rural and urban case highlight the importance of state actors not just as resource provider but also as the authority who needs to take an active responsibility of involving the users, especially in managing commons such as lakes as an area undergoes urban transformation. Thus, beyond pure description of the role of bridging actors, our cases corroborate Foster [68] highlighting that support of state actors is a prerequisite for managing commons such as lakes collectively. This can be seen in the lack of co-management of the peri-urban lake, attributed to the absence of a shared understanding among and within actors, amplified by urban development leading to heterogeneity, perceptions, lack of trust and credibility among actors. Though the local administrations play the role of bridging actor between state (MIdept) and the users, these interactions are mainly mandated by law, and have not enabled co-management in peri-urban lake - confirming the statement by Sayles and Baggio [15] that mandated collaborations are not productive in enabling co-management.

In our study, we further find that that diversity in socio-ecological contexts and particularly socio-economic heterogeneity influence networks managing lakes and the mode in which bridging actors emerge. It seems to mainly depend on the community of users (homogeneity or heterogeneity) and the associated importance for the lake. Specifically, we see that the rural community is highly homogeneous and is dependent on the lake for its livelihood. Hence, the community in a bid to conserve their source of livelihood identified a liaison officer to gather information, leading to increased deliberation, building of credibility and co-management. In contrast, we identify that a heterogeneous urban community with limited information and dependence on the lake for livelihoods were not very motivated to contribute towards lake management. Therefore, the state actor identified a third-party organization not local to the area to secure funding and organise the local community for lake management. Hence, the state custodian invited UWB to act as a bridge between state and non-state actors leading to co-management of the lake.

4.6 Conclusions

In this paper, we characterize and describe the role of bridging actors in the establishment of networks for co-managing lakes along a rural-urban gradient in GBMR, India. As indicated by Lee and Krasny [4], our study contributes to the literature on the role of bridging organization by describing the role of actors in enabling co-management. The paper adds to the limited literature which understands bridging actors as agents to promote beneficial networks aiming to manage small-scale interconnected natural resources in developing countries. We also contribute to the literature on how social networks shape and are shaped based on the ecological context (rural-urban).

In this paper, we developed a framework to categorise bridging actors based on various typologies available, illustrating the role of bridging actors enabling lake co-management along a rural-urban gradient. For this purpose, we develop social networks based on quantifying qualitative data gathered from key informant interviews and focus group discussions. Further, as indicated in section 3, the watershed is unique as the lakes filled with wastewater are used to irrigate multiple crops a year leading to a high dependence on agriculture. To illustrate the framework the paper assessed the role of bridging actors in developing networks across the three lakes, which however, cannot be considered representative of over 1000 lakes in the region. These lakes have varying degrees of actor involvement depending on various factors such as dependence of the resident community on the lake and the government departments in charge of managing them. For example, to arrive at a generalization of our findings concerning the role of socio-economic heterogeneity requiring state involvement for bridging actors to emerge further research covering larger number of lakes across urban, peri-urban and rural areas of GBMR would be necessary.

In this paper we focus on the role of bridging actors within networks enabling lake management by not only aiding networks through information exchange, but also connecting actors to diverse sources of resources that are essential in adaptive governance of natural resources. Along the rural-urban gradient, we see that both state and non-state actors can initiate and develop bridging actors for lake management, though the reasons for initiation are contextual. From the considered cases, we see that both in urban and peri-urban lakes state sponsorship plays an important role in the establishment of bridging actors, whereas the bridging actor in the rural area was more self-organised in addition to the presence of state-sponsored actors. We conclude that irrespective of the social-ecological context, the position of bridging actors plays an important role in the facilitation of interactions within the networks. Further, specifically in the urban and per-urban contexts of social-ecological (and socio-economic) heterogeneity, we found that state engagement in promoting bridging actors played an important role whereas in the rural, more homogenous context, communities established bridging actors through self-organization. Bridging actors who are state-sponsored are mainly positioned as central co-ordinators, as is seen in all the three cases (refer to Table 5). The bridging actor in the urban lake, which is a third-sector organisation, though state-sponsored, is positioned both as a central co-ordinator and a peripheral connector as it draws on its connections based on previous work on lake conservation and management in the city. In the rural case, the need to conserve and protect their source of livelihood has required the bridging actor to position themselves to connect to external sources of information and thus, as a peripheral connector. On the whole, we found that presence of bridging actors helps overcome state scepticisms, builds credibility,

and develops shared understanding among heterogeneous actor groups, promoting co-management of lakes across the rural-urban gradient.

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5. Chapter 5: Overarching Discussions, Conclusions and Outlook

5.1 Overarching Summary and Discussion

The main aim of this dissertation has been to investigate and understand how urbanisation has influenced the governance of water-bodies such as lakes. In order to discuss these issues, the dissertation presents three empirical case studies of three interconnected lakes within a single watershed and along a rural-urban gradient. Figure 10 summarises the three research objectives, with the different data used for each of the research objectives and the important findings.

Urban transformation has led to changes in both the biophysical context and the ecosystem services derived from lakes. This is clearly seen in all three cases along the rural-urban gradient, where there has been a loss of social and cultural services associated with the lakes in the rural and peri-urban areas due to the inflow of wastewater from upstream urban areas and transformation of once seasonal lakes to perennial source of water. This transformation has led to continued agricultural lifestyle with an increased dependence on the lake for livelihoods in the rural and peri-urban areas. The inflow and use of wastewater has had a negative impact on the health of humans, cattle, soil, and the ecosystem. The negative impacts of wastewater have led to a loss of social and cultural services derived from the lake. This is in contrast to the urban case, where there has been a decline in the production services and an increase in the social and cultural services derived from the lake. This change in the services derived can be attributed to land-use change from a rural agrarian land-use to an urban land-use (with a population growth of nearly 140% in the last decade) leading to an influx of new residents who are no more dependent on the lake for their livelihoods. Thus, changes in the biophysical have led to changes in the valuation of the lakes along the rural-urban gradient. These findings are in line with other studies in the region by Mundoli et al. (2017, 2014); Nagendra & Ostrom. (2014).

These changes in the biophysical and ecosystem services have led to changes in the power asymmetries among the actors involved in lake management. This is investigated in the first paper, where using the distributional theory of institutional change, I understand how urban transformation and changes in exogenous formal institution, especially state takeover of lakes as state property in the 1960s have influenced actor choices, values and informal institutions associated with lake management. It is identified that urban transformation has led to changes in the power asymmetries of actors involved, leading to negotiations of new institutional arrangements. It is identified that urban transformation has led to changes in the mental models

of the actors involved in lake management, leading to changes in the valuation of the services derived and has increased the costs of interaction among them. There has also been a change in the governance technologies, mainly in urban areas, where fencing of lakes leads to alienation of local communities but, in the process, protects the lakebed from encroachments, as is seen in our urban lake. Urbanisation has also increased the heterogeneity not just among the community (residents around the lake) but also the state and non-state actors (NGOs, Research and CSR agencies), further increasing the transaction costs and thus, reducing the distributional outcomes for actors to interact. The presence of third-sector organisations such as non-governmental organisations and community-based organisations, who have been working with the state custodian, has overcome state scepticism towards community involvement in managing lakes. These third-sector organisations are also responsible for the development of shared understanding by organising heterogeneous communities as well as securing private funding through corporate social responsibility schemes for managing the lake. Changes in the interrelated institutions have enabled communities, state custodians and third-sector organisations to sign tri-partite agreements leading to a reduction in transaction costs of transactions, thus enabling cooperation and co-management.

In contrast to the urban lake, the peri-urban and rural lakes are recipients of upstream wastewater, leading to continued agrarian livelihoods. In the peri-urban areas, continued agriculture due to expansion of irrigation channels has led to creation of diverse mental models among the resident communities and has reduced the distributional outcomes for cooperation among the community. Expansion of irrigation channels has added new dependents (actors) who are sceptical of the management practices of traditional users living along the lake. Thus, increasing the transaction costs, which is augmented by the absence of interactions between communities and respective local governments. This is in contrast to the rural lake where members of community motivated by their high dependence on the lake coupled with stories of urban communities working to conserve their lakes, have nominated a "field officer" to liaise with the state custodian. Information gathered by the officer is used by the community to deliberate within themselves and with the state agencies to build trust and social capital over the last eight years. This has helped reduce the costs of interactions and scepticism leading to realignment of goals and cooperation between actors, which has led to the digging of a second lake in the village.

1 Negotiating a change

Research Question 1: How has urban transformation gradually influenced power asymmetries and differential outcomes of the actors leading to negotiation of new institutional arrangements of lake management.

Data: Primary Qualitative data from Key informant interviews and Focus Group Discussions

Findings: Negotiating a change due to changes in the valuation of ecosystem services derived. Increased transaction costs with urban development and heterogeneity. Change from state management to co-management of lakes since 1960s.

2 Pre-conditions for Co-management

Research Question 2: How pre-conditions of legitimacy, shared understanding, and resource exchange, facilitate co-management of lakes.

Data: Primary Qualitative data from Key informant interviews and Focus Group Discussions

Findings: Third-sector organisations play a crucial role in enabling co-management, reducing transaction costs and organising a disjoint actor group. These third-sector organisations act as a bridge by building trust and social capital thus overcoming scepticism.

3 Role of Bridging Actors

Research Question 3: What is the role of bridging actors in enabling co-management along the rural-urban gradient.

Data: Primary Qualitative data from Key informant interviews and Focus Group Discussions for social network analysis

Findings: Bridging actors can be initiated both by state and community sponsorship, though in areas with greater heterogeneity state sponsorship and acceptance is crucial. There is a disconnect between actors involved in lake management based on administrative boundaries leading to problems related to institutional fit.

Figure 10: Summarising the three Research Objectives and their findings

These cases highlight the role of third-sector organisations in reducing costs and increasing the distributional outcomes of actors for cooperation, leading to co-management. Thus, across the urban and the rural cases, there has been a change in lake management from a state managed resources in the 1960s to a more co-managed resource in 2018. Negotiation of alternative institutions is enabled by the third-party organisations, as seen in the urban case (non-governmental organisation) and a community liaison officer in the rural case.

The study further investigated the necessary and sufficient conditions for co-management across the gradient. Three conditions of legitimacy of actors, shared understanding, and exchange of resources among actors, were analysed in research objective 2. The findings highlight that co-management is based on contextual factors as is highlighted by Armitage et al., (2008) & Husain & Bhattacharya, (2004) The study highlights that constellations of co-management across the gradient is based on actor legitimacy, presence of a shared understanding leading to exchange of resources between actors. We identify that all three conditions are necessary and sufficient for active and direct contributions by all actors towards lake management. The findings highlight that though the institutional landscape, which provides legitimacy for community participation, is enshrined in the Constitution of India, the quality of its implementation varies across the cases in line with Rajasekhar et al., (2018). The lack of participation by the community along the gradient is fuelled by the decreasing dependence on the lake, coupled with a lack of trust towards the state and lack of information and knowledge among in the urban and the peri-urban communities, increasing the transaction costs.

Heterogeneity is an important factor in the emergence or the failure of co-management, as it affects preferences and values of actors involved. This also increases the transaction costs by lowering costs of cooperation, as is seen in the urban and the peri-urban cases, and is in line with Ray & Bhattacharya (2011). The biophysical context plays a critical role in development of perceptions and shared understanding, which is a key for active contribution across all three cases, as is highlighted by Mees et al., (2018). A diversity in perceptions of the lake drives each community to work for self-interest and not engage with each other as is exemplified in our peri-urban case. This is in contrast to the rural and urban case, where shared understanding and development of collective identity based on a common appreciation of the lake coupled with information sharing and increased interaction among actors reduced transactions cost leading to co-management. Thus, highlighting the critical role of third-sector organisations in enabling co-management.

The critical role of third-sector organisations in enabling co-management as they act as a bridge between actors, creating a network of actors. To further understand the role of these bridging actors in shaping networks, the thesis investigates them further by identifying three characteristics: the location of bridging actors within the network (central coordinators or peripheral connectors); their role in facilitating interactions (bonding or bridging); and their initiation (top-down or bottom-up). In our cases, we see that bridging actors can be initiated both by top-down seen in urban case and bottom-up as seen in the rural case, respectively. As is seen in the urban case, the bridging actor is positioned to be both the main source of information (central coordinator) and connect an otherwise disconnected set of actors (peripheral connector), thus enabling sharing of not just information leading to development of shared understanding but also amplifying exchange of resources. The same is true for the rural case as well, where the bridging actor (field officer) takes on the position of both central coordinator and peripheral connector. Thus, bridging actors are critical in information sharing, provision to access of resources and help negotiate alternatives in both the rural and urban cases. Bridging actors are mostly non-state actors who facilitate interactions and enable exchange of resources and information, thus taking on the role of both central coordinators and peripheral connectors. The state actors in both the urban and the rural cases are not peripheral connectors but work with peripheral connectors, thus making them a prerequisite for managing commons such as lakes, as indicated by Foster (2011).

The study reveals that there is an increase in the diversity of actors in the network of actors with urban developments. Thus, actor diversity increases with urbanisation as is seen in the urban networks, while the non-urban networks (peri-urban and rural) are homogeneous. In the rural network, the community actors, because of their dependence on the lake for their livelihoods, collaborate with state agencies. In the peri-urban network, due to a lack of shared understanding, overlapping administrative jurisdictions have led to a hierarchical and fragmented network. The high diversity of actors in the urban networks can be attributed to the heterogeneity of actors in an urban setting. It was identified that actors collaborated with others who provide resources that they themselves do not have. For example, communities collaborate with an academic/researcher to understand the science behind lake management, they will collaborate with private companies to get funded, they will work with lawyers to fight illegal encroachments, and so forth. This is enabled by the ease of communication especially, through social media among like-minded actors based on common interests thus, leading to collaborations. Though bridging actors play an important role in connecting an otherwise

disjoint network, these networks are active within administrative boundaries. The bridging actors have not yet connected with actors across the gradient, due to little or no interactions between the actors involved across the urban-peri-urban and rural lakes. This has impacted managing an interconnected series of lakes, where the social actors are disconnected, leading to a lack of holistic management approaches to a connected system of lakes.

5.2 Overarching Conclusions

The study argues that, even though there are studies on urbanisation and its influence on lakes, they are mainly limited to investigating changes in biophysical conditions and its impact on the lake. This dissertation has focused on institutions governing lakes as the centre of investigation to examine how urbanisation influences lake management along a spatial (rural-urban) gradient. Three main objectives have been pursued: first, to understand how urbanisation leads to changes in power asymmetries and distributional outcomes of actors leading to institutional change; second, to investigate the conditions which enable or hinder cooperation between actors to facilitate co-management, and finally, to analyse the role of bridging actors in enabling co-management of lakes.

Comparative case study approach has been employed to study the research objectives. Desktop reviews and secondary document analysis were used to identify case study lakes. This was followed by a scoping visit to the selected sites to gain further insights and primary information. Based on this, three interconnected lakes within a single watershed along a rural-urban gradient were selected as comparative case studies for further investigation. Finally, fieldwork was undertaken to collect qualitative data from officials, communities, researchers, academics, and experts using key informant interviews and focus group discussions.

The main findings of this research have revealed some primary insights regarding the influence of urbanisation on lake management. First, there has been a shift in the management of lakes from the state takeover of lake management in the 1960s to a co-managed resource at present, which includes active participation of both state and non-state actors. Second, the values associated with the ecosystem services derived from the lakes play an important role as the driver of change, leading to negotiation of new institutional arrangements. Third, legitimacy of actors, shared understanding and exchange of resources are all sufficient and necessary conditions which facilitate participation of non-state actors in co-management. Finally, third-sector organisations are crucial for co-management as they not only connect a disjoint network but also help in information exchange, in the process building of social capital and thus reducing transaction costs and enabling co-management.

Given the approach used this dissertation draws the following general conclusions: First, the finding of this dissertation advances the understanding of how ecosystem services influence the power asymmetries and distributional outcomes of actors, which is an important factor for communities to negotiate an alternative institutional arrangement. Thus, the dissertation

(research objective 1) has helped develop a mid-range theory of institutional change in areas of urban transformation by focusing on the role of eco-institutional setting in influencing distributional outcomes of actors in areas under urban transformation.

Second, the findings of this dissertation also propose that the findings advance the understanding of preconditions which facilitate co-management at the local level. Specifically, the characteristics of institutional landscape, common problem definition, salience, efficacy, and resources are important factors, which determine if an actor collaborates with others at the local level. This implies that, besides the commonly studied socio-economic conditions, it is important to integrate actor heterogeneity while studying co-management across a rural-urban spatial gradient.

Third, the dissertation has noted the significance of heterogeneity in influencing transaction costs as an important aspect of urbanisation. Heterogeneity increases transaction costs and lowers costs of cooperation. The intricate relationship between costs and benefits of co-management is context dependent also in relation to how contextual factors shape the mental models of actors towards livelihoods and collaborations. Third-sector organisations help overcome high transaction costs and any insufficient incentives to cooperate with other actors by reducing costs to cooperate. Further, it is highlighted that third-sector organisations are important in managing commons in the urban areas than in the peri-urban and rural areas.

Finally, the study highlights that actors' networks are fragmented compared to the ecological networks (interconnected lakes) based on administrative boundaries, which have practical implications for policies and strategies for managing an interconnected resource such as lakes which fall prey to urban transformation. It is important to note here that the state and non-state (civil-society and private) actors alone will not be able to overcome the negative effects of urban transformation. This shows the need for an emergence of and active encouragement by state to include non-state actors (community, NGOs, private) in not just monitoring, but policymaking and governance. There is a need to involve all actors in self-management of common pool resources which until recently were provided by the state thus, leading to the emergence of new institutional arrangements moving towards the concept of 'governance beyond the state'.

5.3 Limitations and Future Outlook

The study made contributions to the literature on institutional change, co-management and role of third-sector organisations to organise networks of actor in areas under urban transformation.

However, it has its own limitations, which opens doors for future research in the fields of urbanisation and institutional change.

Research Question 2 focuses on investigating the pre-conditions which facilitate co-management of urban commons. It should be acknowledged that only a highly restricted set of explanatory variables are considered for investigation. Each of the variables that are considered is multi-faceted and depends on various social, political, and economic factors which were beyond the gambit of the paper. Further, the study does not consider the environmental effects of co-management on the context and the actors themselves. The consideration of the environmental effects on the actors would be an important aspect to look at in future studies, as these effects influence the perceptions of actors to cooperate and to negotiate institutional change.

Research Question 3, the focus is only on the role of bridging actors within networks in connecting actors involved in lake management. There is a narrow focus only on those actors who are active and directly involved in lake management, providing just a snapshot of the actual realities on the ground. Though this reduces the complexities associated with the huge number of actors involved, especially state agencies, it would be interesting to just look at the network of state actors involved in lake management and provide the realities involved on ground. Thus, it would be interesting to develop and study networks of actor including the indirect actors as well, to understand not just the role of actors, but also to develop a holistic understanding of the complexities involved in lake management as part of future studies. Further, the study uses qualitative social network analysis to assess research question 3, the use of qualitative social network analysis, which makes is subjective, and the network is based on the perceptions of the actors involved in the interviews. There is a need to use quantitative methods capable of capturing the forms of relationships between actors to better elucidate the results.

The study is based on the assumption that the rural-urban gradient represents the different levels of urbanisation. Though this assumption helps in studying the effects of urbanisation, it is essential to consider that this gradient is not a pure idea of urbanisation, as it was observed during the field work that some areas which could be considered rural had undergone landscape modification, had high rates of pollution whereas there were spaces within the urban which had retained its rural characteristics. Such cases are common in the cities of the global South where cities engulf surrounding villages. There have been very limited studies on these spaces, which

need to be investigated to better understand the influence of urban transformation on institutional change.

Finally, it needs to be highlighted that the study was undertaken in a single watershed which is a recipient of nearly half of the upstream urban wastewater, ensuring agricultural practices in the peri-urban and the rural areas. Thus, the findings are contextual, focusing on the local level. The study would have benefitted from a comparison of institutional change in areas where agriculture is not the main form of livelihood.

Overall, while this research contributes to the understanding of power asymmetries and distributional outcomes in negotiating alternative institutions during urban transformations, the effect of the colonial history on the governance of common pool resources such as lake has been scantily touched despite the historical and political realities surrounding institutions governing lakes.

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