Chapter 8

Interventions to Strengthen Institutional Capacity for Peri-Urban Water Management in South Asia

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8.1 The Institutional Context of Peri-Urban Water Problems

In South Asia, urbanization is growing at a rapid pace. The recent “World Urbanization Prospects” report projects India to account for 35% of the global urban population growth between 2018 and 2050 (United Nations, 2018). Cities across the Indian sub-continent are expanding rapidly, increasing the demand for and use of surface water and groundwater. The pressure on local water bodies is especially felt at the urban fringes, also known as the peri-urban space. These are the transition zones during the urbanization process, where the shift from rural to urban is most visible in changing land use, population, economic activities, and institutions (Allen, 2003; Iaquina & Drescher, 2000; Narain, 2010). Many peri-urban communities in India that were historically agricultural in terms of livelihoods are transitioning to other types of economic activities. This transition process, however, varies across contexts. Peri-urban spaces of Kolkata, for example, have seen the emergence of small-scale industries, in particular, dyeing and bleaching factories, whereas areas near Pune are becoming a hub for horticulture and nurseries.

Water plays an important role in shaping the urban transition process. Peri-urban spaces need water for drinking, domestic, and livelihood-related purposes. The source of water for these diverse uses varies across geographic regions. In rain-fed areas of Maharashtra for example, people get water from surface water bodies controlled by dams. In West Bengal, groundwater is the primary source of water for domestic or livelihood activities such as farming (Fig. 8.1a, b). In drought-prone Telangana, water is often drawn from large tanks referred to locally as *cheruvus*

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Fig. 8.1 Types of water sources in peri-urban South Asia: (a) tube-well in Kolkata, (b) well in Pune used for irrigation, and (c) *Cheruvu* in Hyderabad (photos Sharlene Gomes, courtesy The Researcher)

(Fig. 8.1c). Managing water in peri-urban spaces is often problematic, and there are growing concerns of water insecurity in this context across South Asia.

Peri-urban water resources are under threat due to growing demand for, and resulting pressures. Livelihood shifts and migration to the urban fringes change the demands for and uses of water. At the same time, nearby cities also struggle to meet the supply needs of urban residents, requiring service providers to find additional water sources further away. This creates competition for water access and sometimes results in conflicts. Studies from peri-urban regions highlight different conflicts over water. In peri-urban Khulna (Bangladesh), water-related conflicts are found in both the domains of domestic and livelihood water uses. Roth et al. (2019) describe issues between commercial (saline) fish farmers and freshwater fishermen over operation of a canal gate in Alutala. Nearby in Phultala, a court case was filed in 2008 by residents against the Khulna city corporation, to safeguard water access from a large-scale groundwater abstraction project (Gomes & Hermans, 2018). Conflicts between peri-urban villages and local industries have also occurred throughout South Asia; for example, locally led campaigns against brick-making factories and water tanker businesses in the Kathmandu valley (Roth et al., 2019), and dyeing factories in peri-urban Kolkata (Gomes, 2019).

The status of water resources in peri-urban South Asia is in part, a result of the quality and functioning of water-related institutions. Institutions may be defined as

societal “rules” which guide decision-making and interactions (North, 1990). These rules can be both formal and informal. Formal rules are those that are codified and enforced via laws, policies, and regulations, whereas informal rules are socially transmitted norms, customs, and traditions. Both types of institutions co-exist in peri-urban areas. There is evidence that formal institutions for water management are ineffective in many peri-urban areas. This, in part, stems from how institutions are arranged along rural and urban administrative boundaries, leaving peri-urban areas with unclear, overlapping and often fragmented institutions. Hence, clearly defining the roles and responsibilities for water management within this changing institutional setup proves challenging. Moreover, peri-urban areas are sometimes officially considered part of the rural administration.¹ This governance gap leads to unresolved conflicts and increasing water insecurity (Sen et al., 2017). Rural institutions for water management fail to adequately cater to rapidly changing local needs. Often, peri-urban actors utilize informal solutions to manage daily water needs, particularly if they are more effective or have greater local legitimacy than their formal counterparts. Research from the *Shifting Grounds* project highlights how informal institutions help residents from Hogladanga village (in peri-urban Khulna) access drinking water (Gomes & Hermans, 2018).

The significance of the peri-urban institutional context suggests the importance of considering them during problem-solving and in the design of water management reforms. Yet, institutions are often overlooked. This neglect can stem from limited knowledge of the institutional context. Decision-makers require a local-level understanding of peri-urban water needs and what this means from an institutional perspective. Failure to recognize the variability in hydrological conditions or differences in specific rural-to-urban trajectories, for example, can result in institutions that are locally ineffective or become redundant over time as pressures and needs evolve. Similarly, peri-urban villages might overlook certain institutional solutions if they ignore the institutional context when examining local water problems. This can be expected in peri-urban contexts, where decision-making is often fragmented.

These challenges suggest a need for capacity building at both levels. When the underlying problems in peri-urban water governance relate to institutions, capacity building offers actors the ability to navigate their institutional context during problem solving. In this chapter, two types of structured, participatory approaches are explored, both of which emphasize the institutional elements of problems faced in peri-urban contexts. They offer guidance to researchers and practitioners working with peri-urban actors to strengthen water governance during urbanization.

¹Although the provision of *Nagar Panchayats* (Notified Area Councils) in the 74th Amendment Act (1992) in India, for instance, was meant precisely for transitional spaces like this, it is often not implemented (Shaw, 2005).

8.2 Supporting Peri-Urban Decision-Making Through Capacity Building

A number of contextual features are important to consider when designing interventions for peri-urban areas. First, the uniqueness of the institutional context demonstrates why institutions are important to consider in the framing and analysis of peri-urban dilemmas. Institutions are especially relevant if the prescribed rules, their interpretation, or their implementation lie at the root of the problem. Here, actors' perspectives of the problem may be enhanced by framing them through an institutional lens. In some cases, this helps ensure that actors address the "right" problem, while in others this perspective can open up the solution space including the possibility for institutional change.

A second point is the inherent multi-actor nature of this context. The term "peri-urban" by definition refers to transitional spaces, therefore, problems typically involve a diverse set of users and decision-makers. Its social composition also evolves over time. Planning and management of water resources requires taking into consideration the needs and concerns of multiple actors. Here, outcomes are the result of negotiations and trade-offs. Therefore, knowing how to navigate this multi-actor space is valuable. Furthermore, cooperation serves as an alternative strategy to address problems during urban transitions when decision-making is fragmented. Here, problem-solving efforts can benefit from a deeper understanding of the actors, their objectives, resources, and values.

Third, peri-urban water resources exist in a larger system that is both complex and dynamic. In addition to the hydrological complexity of the resource itself, the system is also shaped by the institutions and actors who use and apply them in their role as resource users, providers, managers or regulators. This requires an integrated approach to tackling peri-urban water challenges, recognising the competing needs between actors, different sectors, or across scales. In South Asia, where decision-making is, at times, constrained by politics or department-level operational and financial silos, solutions may require adjusting the underlying rules. Meanwhile, the dynamic properties of the system are associated with the transitional nature of peri-urban contexts. Solutions and plans for today's peri-urban challenges may fall short or, worse, have unintended consequences in the future as these areas evolve. This calls for a longer-term view of the problem and planning for a range of different, plausible futures. These three contextual elements of peri-urban areas are relevant during capacity building.

A number of established and emerging disciplinary theories, methods, and approaches may be used as the starting point for structuring capacity building interventions. Depending on the context, purpose, and targeted beneficiaries, practitioners may draw from fields like action research, operations research, and policy analysis, among others. Each offers approaches and methods to support problem structuring, diagnosis, and planning activities in peri-urban contexts. Their selection and combination depends on the type of peri-urban challenge the intervention is design to address. The following sections demonstrate how Community Operational

Research (COR) and adaptation pathways are used as a basis for two different peri-urban interventions in South Asia.

The interventions discussed below are undertaken as part of two separate trans-disciplinary research projects: *Shifting Grounds* and *H2O-T2S* project in urban fringe areas. Both projects are led by an international consortium of partners from academia and practice. The goal in both is to support decision-making during urban transitions through scientific research and participatory stakeholder engagement. While both projects focus on peri-urban water management, the targeted beneficiaries and capacity building needs differ. For this reason, two structured approaches—the APIA and Transitions Pathways—are outlined below. They serve as the starting point for intervening in the institutional context of water-related challenges in peri-urban South Asia.

8.3 APIA: Approach for Participatory Institutional Analysis

To support the community-led institutional change objectives of the *Shifting Grounds* project in the peri-urban Ganges delta, the Approach for Participatory Institutional Analysis (APIA) was developed. Its design draws from Community Operational Research (COR), a sub-discipline of Operations Research. COR applies OR tools and methods to support marginalized communities (Johnson, 2012). It emphasizes a contextual, systems level analysis of societal problems through active stakeholder participation (Gomes et al., 2018). In the urbanizing Ganges delta, peri-urban communities are isolated from decision-making arenas, resulting in a mismatch between local groundwater needs and institutions, and a narrow solution space for the affected communities to select from. Therefore, the APIA was designed and used in the project as a structured approach to help marginalized communities explore groundwater problems and possible solutions through an institutional lens. The intervention undertaken over 4 years (2014–2018) was expected to build capacity for locally-driven institutional change.

8.3.1 Overview and Methods in APIA

APIA consists of four main steps (Fig. 8.2). Step 1 is about problem identification. Here, peri-urban actors identify their most pressing problems and define the boundaries of that problem for further analysis. The criteria for selecting problems that are amenable for further analysis through APIA are threefold: they reflect problems that are complex and dynamic, multi-actor in nature, and have a distinct institutional feature that requires further attention during the problem-solving process. Once a list of problems is generated, actors prioritize them in order of importance, using a simple ranking process. Taking up the most pressing problems in APIA encourages buy-in during the intervention. Thereafter, the challenge is to define problem

Fig. 8.2 Overview of the APIA (Gomes, 2019)

boundaries. To structure this discussion, methods like stakeholder analysis, social maps, and simple mind-maps or causal diagrams may be used to define the actor, geographic boundaries, and causal relations respectively in the problem.

In step 2, the institutional context of the selected problem is mapped and analysed. For this, the Institutional Analysis and Development (IAD) framework by Ostrom (2005) is a useful guide for the data collection and mapping exercise. The IAD framework is rooted in theories from the field of institutional economics and draws conceptual linkages between institutional and other important contextual features, the multi-actor context (referred to as the action arena), and the outcomes of the problem. Feedback loops in the framework also offer a dynamic view of the system. They help create snapshots of peri-urban issues over time. The desired outcome of step 2 is to familiarize users with the institutions underlying their problem, not simply as stand-alone aspects of the system but in terms of how these institutions are operationalized by actors during decision-making, interactions, and resulting outcomes.

From this larger overview of institutional features in step 2, step 3 zooms in to the multi-actor interactions within the problem. Game theory models are used to structure and analyse actor behavior as a game consisting of actors (or players), actions (or moves), outcomes, and payoffs (or utility) (Rasmusen, 2007). This method is applied in step 3. Actors in the game have a set of actions to choose from depending on the situation they face. The combination of actions by different actors produces an outcome. Outcomes offer some utility to the actors, however, some outcomes are better than others in this regard. In this way, the solution space of the

problem is analysed. Although institutions are not an explicit input in a game theory model, they define the “rules of the game”. In this way, institutions provide the rules for players in the game, their actions, and overall structure of the game. In step 3, different types of game theory models can be constructed depending on the type of problem being examined. Non-cooperative game theory models are used in situations with fixed rules and where actors pursue individual interests, while cooperative game theory models explore situations where there is a willingness for coordination and sharing of resources (Hermans & Cunningham, 2018; Madani, 2010; Slinger et al., 2014).

Step 4 builds on the results of step 3. Strategy exploration is meant to give users an interactive, immersive experience in the solution-finding process. To facilitate this, game theory models are translated into role-playing games. Gaming-simulation methods simulate real-world phenomena in the roles, rules, and incentives of a game (Meijer & Hofstede, 2003, cited in Meijer, 2009). Game design handbooks call for designs to be based on the purpose and the context in which it is used (Duke, 1980; Greenblat, 1988). A simple role-playing game facilitated with the use of a game board is sufficient. Peri-urban actors take on the role of one of the players in the game. Through role-play, participants experience other actors’ decision-making processes in different problem scenarios. Multiple rounds are played to allow for the comparison of outcomes from different strategies. At this stage of APIA, the goal is to build capacity on several fronts: first, knowledge about the other actors in the problem, their values, resources, and strategic preferences; second, potential solutions to the problem both in the short and longer term; third, building skills to negotiate these solutions in the real-world.

8.3.2 *Piloting the APIA in Peri-Urban Khulna*

Khulna is the third largest city in Bangladesh. Peri-urban areas of this city are extremely dependent on groundwater for almost all purposes. There is evidence of groundwater scarcity, contamination with iron, salinity etc. as a result of overexploitation. One such peri-urban location affected by the groundwater crisis is Hogladanga village, situated approximately 7 kms away from Khulna. Located close to the expanding city, the village is isolated from the rural administration that is responsible for water supply services. Officially, Hogladanga falls under the administrative jurisdiction of the Bhotiagata sub-district or *upazilla*. Lack of access to policy-makers and decision-makers at this level limits the community’s ability to effectively address the groundwater issues it faces. To support problem-solving efforts in this village, an APIA-based capacity building intervention was undertaken by partners in the *Shifting Grounds* project. Through an improved problem understanding and platform to engage with local decision-makers, community capacity to intervene institutionally in groundwater management problems was expected to improve. With the help of a local partner based in Khulna, structured stakeholder

engagements were undertaken over 4 years in the form of site visits, mango tree meetings (regular, informal meetings in the village with village residents) and workshops (formal, multi-stakeholder meetings in Khulna city).

The intervention began with step 1. Hogladanga residents came up with a list of concerns. Although the project focused on groundwater, the types of problems identified included surface water issues, livelihood insecurity, and waste management among others. Ultimately, locals identified access to safe drinking water supply as a priority concern for their village. Groundwater forms a significant part of this problem, as the village continues to rely on tube-wells for accessing drinking water and no surface water options are available. Further discussions on their negotiation strategy revealed that the problem comprises two aspects: availability of drinking water infrastructure and drinking water quality. A social map (Fig. 8.3) was also prepared with the help of local facilitators from Jagrata Juba Shangha (JJS) to demonstrate the extent of the problem.

Fig. 8.3 Social map of drinking water supply in Hogladanga. (Image courtesy Jagrata Juba Shangha 2017)

In step 2, the project team (comprising the author and the local partner, JJS) worked with the community to map the institutional context of the drinking water problem. Institutions briefs explaining the formal rules for water supply in Bangladesh were developed and shared with the residents. This was necessary as the village population's understanding of formal rules was limited. The brief contained infographics and short descriptions of key laws, policies and guidelines to supplement discussions in step 2. Subsequently, a workshop was conducted to discuss the findings of institutional mapping. Step 2 highlighted the different phases of the problem. The first phase refers to the initial drinking water problem. It offered insight into why formal rural institutions failed to supply adequate tube-wells to meet the needs of the community. This was due to limited resources for drinking water infrastructure, high demand for public tube-wells, and the politics of distributing tube-well licenses, all leading to an outcome of water insecurity. This was also because, over time, groundwater levels began to decline and tube-wells that had been installed at 400 - 450 ft. depth no longer supplied good quality drinking water. Thus, residents were in need of tube-wells at a depth of 1000 - 1500 ft.

To cope with this, residents looked for informal solutions, thus entering the second (current) phase of the problem. There exists a practice of tube-well sharing between households. Those who could afford it began investing in private tube-wells. These tube-wells are also shared with neighbouring residents. This acts as a makeshift solution to access groundwater for drinking purposes, while residents continue to apply for additional public tube-wells alongside.

In the near future, a third phase of the drinking water problem is expected. A proposal to expand the urban boundaries of Khulna city could bring peri-urban villages into the urban jurisdiction. When this happens, formal institutional arrangements will change from rural to urban, as will the options for drinking water supply, as Khulna city is already supplied with treated surface water via pipelines. Public tube-wells would likely continue to be used in some urban areas in this scenario. The quality, affordability, convenience and reliability varies between these options. Moreover, it was unclear whether water supply projects that were being constructed at the time would cater to the needs of the future urban population. As a result, informal options like private tube-wells and bottled water may still be relied upon in the future.

In step 3, the project team developed game theory models of strategic behaviour using inputs from village residents and other actors. Three models were constructed, each corresponding to a different action arena in the problem. A non-cooperative model represented the existing situation for accessing drinking water infrastructure. A second non-cooperative model represented the future drinking water situation. The collection of improved groundwater data was considered as the first step in addressing the drinking water quality problem, as decisions on the installation of tube-wells were constrained by a lack of aquifer understanding. Hence, a third cooperative model was set up to explore the potential of cooperative strategies to improve groundwater monitoring.

The three game theory models offered several analytical insights for the researcher into the understanding of why actors behave the way they do in drinking water problems, as well as potential solution strategies to address them. However,

the models on their own were not easy to interpret by residents from Hogladanga, who lacked a basic understanding of game theory. Representing payoffs as numerical values, for example, paints an abstract picture of a very real problem. Earlier stakeholder discussions in step 3 had expected this, as model inputs like values were difficult to discuss with many residents. Therefore, model results were not presented to the community after step 3. Instead, each model was translated into a role-playing game, as a medium of communication in step 4.

Strategy exploration in step 4 was conducted through an interactive gaming-simulation workshop with Hogladanga residents. Three game sessions were conducted during the workshop. They were facilitated with a game board with movable pieces that was customized in each game. Players were given materials such as role description cards, action cards, resource cards, and scorecards to evaluate outcomes. Participants took on the role of one of the players in the game and were asked to explore the drinking water problem through role play using the materials provided.

In game 1, participants explored solutions to access drinking water supply in the current (peri-urban) scenario. In game 2, they examined the same problem in the future (urban scenario). In both game sessions, players used their resources to make actions, the combinations of which produced an outcome that was then evaluated by scoring their satisfaction level against their players' values (Fig. 8.4). Three rounds were played in both games, allowing participants to explore different strategies to address the drinking water problem. In game 3, participants compared the outcomes of cooperative groundwater monitoring with the round where all players monitored

Fig. 8.4 Strategy exploration through role-play in step 4. (Photo Sharlene Gomes)

the resource individually. In this game, players used their resources to negotiate cooperative agreements. Two rounds were played and outcomes were similarly evaluated against their players' values.²

8.3.3 Impact of the APIA in Peri-Urban Khulna

Evaluating the impact of the APIA in Hogladanga was done at each step of the intervention. The direct effects on the community's problem understanding, methods, and facilitation were the evaluation criteria. The intervention highlighted the complexity of the problem. Drinking water insecurity had both infra-structural and quality aspects and, furthermore, changed over time due to urbanization. Understanding the existing situation served as a baseline for comparing alternate scenarios. Institutional mapping built capacity on two levels. First, on the level of the formal institutions that related to water management in general and drinking water supply more specifically. Second, the IAD analysis demonstrated how both formal and informal institutions were operationalized during decision-making and the actors who were involved in the problem over time. Some residents from the village highlighted that the future scenario was most valuable as they had little knowledge of who and what kinds of water supply services would be available.

Further, the community recognized the limits of their solution-finding abilities, given their lack of access to the sub-district administration. Still, APIA findings helped understand the reasons why their preferred outcome may not be feasible, while allowing for a comparison of alternatives. In step 4, the role-playing exercises offered more specific details about the other actors involved in the problem, some of which were previously unknown. Although the intervention did not lead to a new solution, analytical abilities with regard to the solution space improved. For example, in step 4, participants commented on how different strategies require negotiating with different actors and moreover, that these strategies are valued differently by each actor. Negotiation experience was also built during the cooperative game. Participants commented on the challenges of negotiating with certain actors, realizing their own role in shaping solutions. This was important, as the community would have to sustain engagements with the government beyond the project.

In terms of methods, visual forms of engagement were positively evaluated in each step. For example, in step 2, while some residents found it difficult to interpret the contents of the institutions brief, the infographic was easily understood. Similarly in step 4, the game board and outcome evaluation scorecards were appreciated. Despite the time needed to initially familiarize with game materials, participants enjoyed the visual and interactive medium of the games itself.

²For a more detailed account of the strategy exploration workshop, see Gomes (2019).

The role of the local facilitators was critical in the implementation of APIA for different reasons. First, as they were based in Khulna, they had a good local network to support the research activities in each step and were also able to meet regularly with the community. As many as 11 meetings with local households were held over the course of the project. Second, discussing problems of a somewhat sensitive nature was possible thanks to the initial time spent by facilitators to build relationships with the community and convey the goals of the project. Third, this intervention also gave facilitators new skills, as each step of the APIA were implemented with their help in the local language. Since this project, JJS has applied the APIA in other projects in Bangladesh (Hossain et al., 2019). Having the same team of facilitators throughout the intervention brought a sense of ease to the discussions. It was observed how women, who were initially reserved, actively engaged in the game sessions and took part in some of the multi-stakeholder dialogues with local government representatives.

Overall, the APIA was a good fit for the type of problems experienced in Hogladanga. Their objectives for participating in this intervention were clear: they wanted a solution to their drinking water problem. While the *Shifting Grounds* project offered a platform to engage regularly with local decision-makers, the APIA offered them knowledge and skills to guide these discussions. In this context, institutional capacity building was achieved through this APIA-based intervention, although wider impacts are yet to be seen.

8.4 Transformative Pathways for Sustainable Peri-Urban Water Management

Policy planning for water management requires a new paradigm, given the uncertainty regarding the future, an important aspect that traditional static plans fail to adequately prepare for (Haasnoot et al., 2013). An adaptive approach that is future-oriented guides decision-making by predicting system changes over time and making strategic plans to manage them. In this way, it combines short-term action with longer-term goals. This is the objective of the Adaptive Pathways approach. Haasnoot et al. (2013) show evidence of this approach being applied to water management in New York, the Rhine and Dutch Deltas, and the Thames estuary. While climate change has been the driving force behind many applications to date, its use in helping peri-urban areas cope with the uncertainty of urbanization had not been explored. Sources of uncertainty in peri-urban water management include anthropogenic factors (such as population, land use change, and economic activities), climatic factors, as well as institutional factors. For example, water resources may be affected differently depending on whether peri-urban areas remain under rural administration, form a *Nagar panchayat*¹ or a new municipality, or get absorbed by a large metropolitan city. Such a future offers both threats and opportunities to water governance. Failing to adequately prepare for the future means that decision-makers

will continue relying on ad-hoc coping strategies if today's management plans fail to hold up over time. This can hamper the sustainability and resilience of urban transitions.

To support a more adaptive approach to peri-urban water management, the adaptation pathways approach may be used to structure policy interventions. The *H2O-T2S in Urban Fringe Areas* project does this through the lens of vulnerability and resilience. The project is executed in peri-urban areas of three metropolitan Indian cities: Pune, Hyderabad, and Kolkata. Two peri-urban villages are selected in each context. Through field research and local stakeholder workshops, context-specific vulnerabilities in peri-urban water resources are identified. Baseline studies examine the existing adaptive capacity in each case study to respond to opportunities and threats. These preparatory research activities look at three dimensions in an integrated way: institutions and governance, domestic water access, and livelihood water uses.

Distinctive past and current transformative pathways provide the starting point for exploring future scenarios (Sen et al., 2017). For this, multi-stakeholder workshops are planned as the next step in the project wherein decision-makers, local community representatives, and other experts co-design transformative pathways. The intervention is expected to help peri-urban areas, through their institutional context, cope with short-term vulnerabilities while also stimulating resilience in the longer term (Sen et al., 2017). This forms the intervention phase of the project. These workshops offer a new conceptual approach to govern rural to urban transitions. Local stakeholders in the three case study areas build on the status quo to work towards more sustainable pathways for the future (Sen et al., 2017). In this way, the approach is tailored to the local context.

The three-year project (which began in late 2018) was in progress at the time this book was published. Therefore, it is not possible to demonstrate the results of this approach in peri-urban contexts. Instead, the following section outlines the main steps in the design of transformative pathways. Further, it briefly describes the unique vulnerabilities faced by peri-urban regions around India to highlight key factors to consider during the intervention.

8.4.1 Methodology for Designing Transformative Pathways

Conceptualizing transformative pathways for peri-urban water management makes use of the adaptation pathways approach. Several articles and application manuals outline different stages in the preparation and design of pathways (Bosomworth & Gaillard, 2019; Butler et al., 2016; Coulter, 2019; Haasnoot et al., 2013). For the peri-urban context, these have been adapted as follows:

Stage 1: Define Goals and Objectives

Peri-urban actors start by formulating a clear vision and goals with regard to water management in the future. They define this objective based on what is important for

those involved, their key concerns etc. Here, representation of key peri-urban stakeholders is important, as is clarifying the scope for this objective. On the one hand, having a broad scope is relevant in peri-urban contexts, given the complex, dynamic, and multi-scale characteristics. On the other hand, focusing on a specific type of water management issue or on a particular region keeps adaptation planning exercises manageable for first-time users and generates more context-specific vulnerabilities, future options etc. For example, the opening session of the project conducted by Butler et al. (2016) in Indonesia describes the geographic focus in the intervention in administrative terms (e.g. provincial or sub-district level).

Stage 2: Explore the Current Situation

The current situation refers to drivers of change as it relates to water resources. During this stage, workshop participants describe their operational practices used for peri-urban water management around three aspects: institutions, domestic and livelihood water uses. Here, drivers refer to the underlying causes of issues that concern to peri-urban actors (Butler et al., 2016). This exercise is meant to understand the types of peri-urban vulnerabilities and adaptive capacity that already exists within the system. Facilitators should stress the value of different sources of data and perspectives of the situation, to avoid discounting local and traditional knowledge. Research findings by the project team also serve as inputs during the discussions in stage 2.

Stage 3: Analyse Possible Future Scenarios

Participants describe possible futures for peri-urban water management. Considering a wide range of future scenarios is the strength of the approach. Their desired vision for the future must feature in the list of futures and could even be used as the starting point for discussions regarding alternatives. The remaining futures may be ranked according to how they meet the goals and objectives of peri-urban stakeholders. The business-as-usual, best, and worse-case scenarios may also be identified. It is useful to visualize each scenario using pictures or name them for easier discussion in the subsequent stages of the intervention (see e.g. Butler et al., 2016; Vervoort et al., 2014).

Stage 4: Design Pathways

The design of adaptation pathways can be done by forecasting from the present or back-casting from shared desired future goals (Vervoort et al., 2014). In the forecasting approach, the more commonly used of the two, users begin by identifying actions to address the existing drivers of vulnerability. For each action, a tipping point is identified for that action based on a future system condition. These tipping points serve as triggers for decision-making. One way of identifying potential tipping points is by combining information from current and future scenarios (Coulter, 2019). They explain that a tipping point may have negative consequences (e.g. actions are no longer effective, the point of no return) or may be positive, creating opportunities (e.g. funding, leadership changes). Before reaching this point, peri-urban actions will need to shift to an alternative course of action better equipped for that future condition. For this, a suitable trigger is needed. The type of monitoring

Fig. 8.5 Example of an adaptation pathways schematic. (Adapted from Haasnoot et al., 2013)

and capacity to enact defines how far in advance these triggers are needed (Coulter, 2019; Haasnoot et al., 2013). Next, users identify actions that are robust against a range of possible futures. Promising responses can be clustered together to form the basis of transformation strategy and thereafter, arranged into logical sequences over time, resulting in transformative pathways (Sen et al., 2017). A commonly used schematic for visualizing adaptation pathways is that of a metro map (Fig. 8.5).

Stage 5: Evaluate Pathways Schematic

This helps compare between responses over time and against the goals of the stakeholders involved. Here, trade-offs may be needed with those who bear the cost from that option or have a preference for a more desirable one. Scorecards may be used during the evaluation stages as shown below (Fig. 8.6). This leads to an identification of preferred adaptation pathways.

8.4.2 Water Related Vulnerabilities in Peri-Urban India

Since the project's inception in 2018, a selection of six peri-urban case studies across 3 Indian cities was made. They include the villages of Paud and Uruli Kanchan (Pune), Anajpur and Bowrampet (Hyderabad), Badai and Hadia (Kolkata). Thereafter, the H2O-T2S project team conducted preparatory research activities in the form of site visits, key informant interviews, and focus group discussions with peri-urban stakeholders in each site and government representatives from the local up to the state government level. This offers an initial impression of water-related vulnerabilities across peri-urban locations.

The three regions are shaped by different agro-climatic and hydrogeological conditions, creating differences in resource environments. Moreover, as water is a state subject in India, selecting sites in different Indian states allows for a comparison of

Fig. 8.6 Example of a scorecard used to evaluate adaptation pathways (Haasnoot et al., 2013)

Path actions	Relative Costs	Target effects	Side effects
1	+++	+	0
2	+++++	0	0
3	+++	0	0
4	+++	0	0
5	0	0	-
6	++++	0	-
7	+++	0	-
8	+	+	---
9	++	+	---

institutional contexts as well. As a result, water dependencies and urban transformations differ significantly across and even within states. For example, major economic activities in Badai and Hadia village, both situated in peri-urban Kolkata, include dyeing factories and wastewater aquaculture respectively. In Badai, this stems from the access to affordable groundwater needed in the manufacturing process. Meanwhile in Hadia, situated in a wetland region, fishermen have access to a large wastewater canal from Kolkata city for fish cultivation. Although both types of economic activities benefit from the access to markets in Kolkata, the need for different water resources as inputs shape their unique economic activities.

Not surprisingly, peri-urban vulnerabilities across India were also context-specific. Paud, situated near Pune in the western Ghats in Maharashtra, has access to surface water resources from large nearby dams. In contrast, Anajpur and Bowrampet near Hyderabad face water shortages as they are situated in drought-prone regions. Furthermore, in Kolkata, some peri-urban areas where local aquifers are contaminated with arsenic or salinity face water insecurity. However, vulnerability does not stem solely from the biophysical environment. Water demand for one use is seen to have knock-on effects elsewhere in the community. For example, small factories are blamed for the release of raw effluents into local surface water bodies. As a result, local farmlands in Badai have, in the past, become contaminated by the release of wastewater from nearby dyeing factories. This resulted in agricultural losses for some peri-urban farmers. Historically, such tensions are also found in Anajpur village between surrounding industries and local farmers, poultry farmers and cattle herders. Meanwhile in Paud, ongoing construction of a large housing complex is expected to nearly double the population and, with it, cause a drastic increase in domestic water demand. The developer plans to invest in its own private drinking water supply, although separate from the village. As a result, unequal water access could become a problem in the near future.

The government agencies for water management are also sources of water-related vulnerabilities. In West Bengal, regulation of groundwater abstraction is the responsibility of the State Water Investigation Development (SWID), as stated in the Groundwater Resources Act (2005). However, implementation capacity at the

block level is limited, as is the sanctioning power to enforce harsher penalties for non-compliance. Meanwhile, interesting institutional set-ups are found in Hyderabad, where urban development centres around the Outer Ring Road (ORR) which surrounds Hyderabad and its peri-urban areas. Drinking water supply within the Hyderabad Municipal area is the responsibility of the Hyderabad Metropolitan Water Supply and Sewerage Board (HMWSSB). Earlier, areas outside Hyderabad city fell under the responsibility of the state government's Rural Water Supply and Sewerage (RWSS), but jurisdiction of the urban service provider was extended to include all areas within the ORR. Therefore, villages within the ORR also receive water from HMWSSB. This example shows how infrastructure to improve urban transportation has also affected the rules for water service provision.

Given these changing dynamics, evidence of adaptation to some of the above mentioned vulnerabilities was observed across the three study regions. Villages like Hadia (Kolkata) and Paud (Pune) are home to cooperative fishing communities (Fig. 8.7). In Paud, the Bhoi fisherfolk are a traditional fishing community, dating back several generations. In Hadia, a large fishing cooperative was formed in 1999. To safeguard their livelihoods from changing dynamics, fishers' co-operatives were established, offering several benefits to members like shared labour responsibilities, access to financial resources for licences, fishing inputs, or emergencies, and risk reduction by sharing profits from fish catch.

With regard to drinking water, the informal sector has helped peri-urban households close the supply gap. Informal providers operate in many peri-urban areas. Small bottled water industries that sell packaged groundwater to neighbouring

Fig. 8.7 Traditional practices of the Bhoi fishing cooperatives. (Photo courtesy C., Butsch)

Fig. 8.8 Informal drinking water providers across peri-urban India: (a) water tankers (left); (b) RO plants (right). (Photos Sharlene Gomes)

villages, for instance, are mushrooming in parts of peri-urban Kolkata. Although many companies claim that the water is filtered, there are concerns that their illegal nature raises questions of the treatment processes and drinking water standards followed. Elsewhere, in peri-urban Pune and Hyderabad, private and NGO funded Reverse Osmosis (RO) plants can be found besides the public RO plants set up by local *panchayats*.³ Private tankers also supply water to peri-urban households and businesses, especially during the dry season, and to larger residential complexes (Fig. 8.8).

8.4.3 Designing Transformative Pathways Workshop

Given the status quo of water-related vulnerabilities and peri-urban adaptation strategies, the next step is to design suitable workshops for peri-urban actors to explore transformative strategies. For this, a number of design choices must be considered. An appropriate level for the intervention needs to be selected. While the *H2O-T2S* project planned for state-level workshops, this choice highlights both pros and cons. On the one hand, it enables a focus on state-level policies to sustainably manage uncertain peri-urban futures. Given the fact that water management is shaped to a large extent by state-level policies, it makes sense to target state-level decision-makers when advocating for a more integrated and resilient approach to peri-urban governance.

On the other hand, representation of all stakeholders' views and inputs is essential in the adaptation pathways approach. To ensure this, state-level decision-makers should also participate. Although the research team has a good local network, the availability and willingness of senior government representatives to attend workshops conducted by research projects can prove challenging. Efforts to familiarize

³ *Panchayat* is the most local government administrative level in rural India.

state-level officials with the project, and what it offers in terms of capacity and data, might be needed earlier on in the intervention. Regular updates from the project team would be another way to strengthen relationships before the workshop phase of the project. Furthermore, participation of local communities is also essential. Meaningful and open discussions between government and peri-urban residents can be difficult, given the power differences between these actors. The project will consider ways to manage this in the design of the workshops.

The preparatory assessment presented in the previous section highlights that, even within the same metropolitan area, significant differences in vulnerability and coping capacities can be found between (and even within) peri-urban villages. Therefore, one should consider how state-level workshops can design pathways that are context-specific. It may be necessary to focus on issues common across case-studies from that region or conduct pathways development exercises in parallel within two smaller groups of participants. Another option would be to begin the pathways exercise in a local-level workshop, with communities and local decision-makers. Once their vulnerabilities and visions for the future have been incorporated, a state level workshop will continue the design of pathways.

The three project regions offer sufficient differences for knowledge sharing in the national-level workshop that is planned at the end of the intervention. This will help put peri-urban governance on the national agenda. Moreover, national-level policymakers will hear directly from the state and local-level actors about their context-specific pathways for managing water-related vulnerabilities during urban transitions.

While there is sufficient literature available on the stages in the adaptation pathways approach, the methods used to facilitate this with stakeholders are less clear. Little has been written about how the approach is applied or tailored to specific application contexts. Co-designing transformative pathways with stakeholders in the *H2O-T2S* project is expected to generate insights on its use as a tool for planning. The experiences gained from multiple project sites are critical. They will contribute necessary improvements to this innovative approach for capacity building, to benefit future uses elsewhere (Sen et al., 2017).

8.5 Institutional Reforms in Peri-Urban South Asia: Ways Forward

In this chapter, I have discussed the important role that peri-urban institutions play in water issues during urban transitions, highlighting a need for capacity building on this particular aspect of decision-making. Two different approaches to capacity building are offered: the APIA and the use of transformative pathways for sustainable peri-urban water management. These approaches may be used to design and structure interventions in peri-urban contexts. Both approaches allow for peri-urban actors to explore decision-making problems through an institutional lens, albeit

with different objectives. The APIA helps with problem diagnosis and strategy exploration during problem solving. In Bangladesh, this was used to help marginalized communities engage in decision-making arenas while addressing local concerns. Transformative pathways, based on the adaptation pathways approach to planning, allow for actors to explore longer-term adaptive plans, given the uncertainty of peri-urban futures.

Structuring interventions in the institutional context of peri-urban South Asia would benefit from these and other similar participatory approaches. Yet more work is needed to further improve, test, and evaluate these methods in real-world applications. While the transformative pathways intervention in the *H2O-T2S* project is still in an early stage, further research on the APIA is currently underway. Further testing of APIA was also conducted in peri-urban Kolkata. Since the *Shifting Grounds* project, a practical manual for APIA has also been developed (Gomes, 2020). This is meant to expand the application potential of APIA beyond peri-urban contexts and marginalized communities. The manual builds on the lessons from the pilot application in Hogladanga by revising the steps of APIA to give users even more ownership in the capacity building process. In this way, users will have the ability to apply the methods of the APIA themselves, while project partners take on a supporting or facilitating role in the process. Application of APIA manual with professionals is currently underway in Bangladesh to train water professions and examine different types of water problems in urbanizing deltas (Hossain et al., 2019).

Reflection on the above two capacity-building interventions to strengthen peri-urban institutions highlights a number of lessons learned and areas for further research. At the outset, it is important to highlight the fact that institutional change is a slow moving process that is not likely to occur within the timelines of a typical research project. Therefore, a meaningful starting point is to focus on a new conceptual framing of peri-urban contexts and its water-related challenges. In many cases, addressing a gap in knowledge or creating a platform to engage with other peri-urban stakeholders is often a necessary and useful first step.

Furthermore, the transferability of these approaches to address different types of problems facing peri-urban actors needs to be explored. APIA, for example, has been evaluated in other peri-urban contexts with other types of actors (e.g. government) and for other types of problems in Kolkata (Gomes, 2019). This helped understand their value and application potential of the APIA in peri-urban contexts, beyond those they were initially designed to support. Similarly, there may be other tools (see e.g. Ducrot, 2009) that may also be potentially useful for structuring peri-urban interventions. A full scan of approaches available in the literature is, however, not part of this chapter.

The timing of these interventions is also relevant. Despite the availability of suitable tools, resources and networks, activities may be influenced by conditions present at the time. Political changes during an intervention can slow or even hamper activities if elected officials are not supportive. Peri-urban areas also deal with problems like inequity as a result of caste differences or corrupt practices. Projects need to be aware of these and other sensitive topics during interventions to ensure that

stakeholders do not face any negative consequences from participating and feel comfortable discussing them during activities.

Facilitation is also extremely important for the success of these interventions. It is useful to have local facilitators, who already have good relationships and networks in the context and are able to conduct the steps in the local language. The results from the *Shifting Grounds* project reflect this. In *H2O-T2S*, local partners represent each of the three metropolitan regions. Nevertheless, the ability to meaningfully engage with senior state and national actors remains to be seen.

The two interventions described in this chapter demonstrate ways in which peri-urban areas may be helped. Through support in decision-making, problem understanding and planning, these interventions build peri-urban stakeholders' capacity to manage their complex, dynamic and uncertain context. The approaches in this chapter present ways of intervening in peri-urban dilemmas with conflicting needs and objectives, through improvements in longer-term planning and more focused problem-solving interventions. It is through a better understanding of the challenges faced in peri-urban contexts that sustainable water governance during urban transitions can be achieved.

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