

Project Background and Design

(abridged version)

Shifting Grounds: Institutional transformation, enhancing knowledge and capacity to manage groundwater security in peri-urban Ganges delta systems

Abstract

Urbanizing deltas in South Asia have seen rapid growth and change. In cities such as Khulna in Bangladesh and Kolkata in India, this has resulted in an increasing pressure on groundwater resources in peri-urban areas. Existing institutions fail to ensure an equitable sharing and sustainable use of groundwater resources in this changing environment, which is evident from the uncoordinated overexploitation of aquifers and a reduced access for vulnerable groups. This project investigates institutional developments, looking at the dynamic interactions between different groundwater users, the groundwater systems and the influence of nearby cities. The insights should help local stakeholders to negotiate institutional transformations that support a more sustainable and equitable use of groundwater resources. Research activities are combined with workshops to strengthen the negotiation capacities of local stakeholders. Khulna and Kolkata provide an excellent basis for an institutional comparison, being part of the same Ganges delta system, yet located in different countries.

Introduction

The Shifting Grounds project aims to build knowledge and capacity among local actors to support a transformation process in peri-urban delta communities in Bangladesh and India for a pro-poor, sustainable and equitable management of groundwater resources across caste/class and gender. This will be based on an improved understanding of the dynamic interplay between local livelihoods, the groundwater resource base, formal and informal institutions and links with nearby urban centres in Khulna and Kolkata. These two cities provide a good basis for an institutional comparison, being part of the same Ganges delta system, yet located in different countries.



Photo: groundwater extraction at Sonarpur

High-quality research on the emerging issue of peri-urban institutions for groundwater management is linked to a structured process to support actor negotiations and to strengthen the negotiation capacities of local stakeholders. These capacity building and development activities are based on the Negotiated Approach, which has been used by civil society organizations to facilitate the involvement of local users in river basin management. This approach will be further developed for application in relation to groundwater management. The use of novel supporting tools and techniques is explored for their use to facilitate these negotiation processes, including serious gaming and game theory, multidimensional (ground)water poverty assessment, and interactive grounded-theory analyses. Participatory monitoring and evaluation of project interventions is used to ensure learning for both science and policy-making. Upscaling and replication of project activities is foreseen through close linkages with ongoing activities and networks, as well as through the embedding of key findings in curricula of academic institutes in South Asia and the Netherlands.

1. Project Outline

(i) Project background and problem/opportunity analysis

Urbanization has been a major change process in South Asian deltas over the 20th century. The rapidly growing cities have an important regional function and footprint, which works through the peri-urban interface that connects urban and rural systems (Allen, 2003; Tacoli, 2006; Janakarajan 2009). One area where this becomes critically visible is in the management of complex, fragmented and composite ground water aquifers of the Ganges delta system. In ongoing research by consortium partners, there is emerging evidence of contestations and conflicts around multiple usages of groundwater (Narain 2009; Khan and Kumar, 2010; Prakash et al., 2011). Increased climatic variability, degrading surface water sources, land use change coupled up with unequal caste-class-power structures, rules, norms and practices create pressure on already strenuous groundwater tables. Lack of access to groundwater during critical periods affects the livelihood securities of the vulnerable and contributes to the incidence of poverty.

Two cities that face such problems and conflicts in the Ganges delta are Kolkata, India, and Khulna, Bangladesh. Stakeholder consultations for the development of this proposal showed that for instance in Sonarpur block, in deltaic south central Kolkata, decreasing groundwater tables, salinity and arsenic contamination have a direct impact on access to safe drinking water. Industries like Pepsi compete for water with rapidly growing housing complexes, while agriculture is suffering from dry spells during summer months. In other areas, such as Barrackpur II block north of Kolkata, high arsenic contaminations supposed to be linked to groundwater depletion. Pressures and conflict over access to groundwater exist between urban domestic, industrial and rural agricultural users. Around Kolkata, an exponential growth in private tube wells in peripheral areas has largely benefited better off farmers, but has also contributed to inequity across different class and caste groups leading to water insecurity (CSE, 2005-06).

In Khulna, overexploitation of groundwater in upstream areas leads to intrusion of saline waters into major groundwater sources (Zahid and Ahmed, 2006; Adhikary et al., 2012) and arsenic contamination has been a major problem for urban and peri-urban communities. Recent attempts by the Khulna City Corporation (KCC) to access new groundwater sources for urban water supply from the peri-urban block Phultala led to severe conflict. Court orders have eventually prohibited the use of these resources by KCC, rendering the KCC investments in transportation pipelines and pumping stations useless. In peri-urban villages of Batiaghata block south of central Khulna, frequent fights take place amongst the shallow tube well owners with regard to ground water usage for irrigation. Practice of fresh water prawn culture has created additional pressure on the already strenuous aquifers, resulting into acute water crises during dry periods.

In response to observed limitations in groundwater resources, future urban water supply is expected to come more from surface water reservoirs that are currently under development

such as the Mayurbati water supply project. However, it is not yet clear what this will mean for future recharge of, and demands on, groundwater resources.

Where multiple actors need to share (groundwater) resources, institutions, seen here as rules, beliefs, norms and organizations that together regulate actors' behaviour and interactions (March and Olsen, 1989; Ostrom, 2005; Greif, 2006; Merrey and Cook 2012), provide key mechanisms for interaction. However, whereas institutions show some degree of permanence, peri-urban areas are highly dynamic. The rapid changes in the environment of peri-urban areas put changing demands on the institutional structures and existing institutions are in a state of flux (e.g. Iaquina and Drescher, 2000; Allen, 2003).

Whereas administrators and regulators express a desire for spatially explicit demarcations of the peri-urban areas to make them amenable to formal institutional arrangements (Annex 6), this desire is difficult to meet. Peri-urban areas themselves are constantly shifting as urbanization progresses; today's peri-urban villages, are tomorrow's urban wards.

(ii) Objective

The overall objective of the project is to build knowledge and capacity among local actors to support a transformation process in peri-urban delta communities in Bangladesh and India for a pro-poor, sustainable and equitable management of groundwater resources across caste/class and gender. This will be based on an improved understanding of the dynamic interplay between local livelihoods, the groundwater resource base, existing institutional systems and links with nearby urban centres in Khulna and Kolkata.

Innovation is enhanced by linking high-quality research on the emerging issue of peri-urban institutions for groundwater management with a structured process to initiate and facilitate actor negotiations, using serious gaming tools. Upscaling and replication of project activities is foreseen through close linkages with ongoing activities and networks, as well as through embedding key findings in academic curricula of institutes in South Asia and the Netherlands.

(iii) Knowledge gaps and research approach

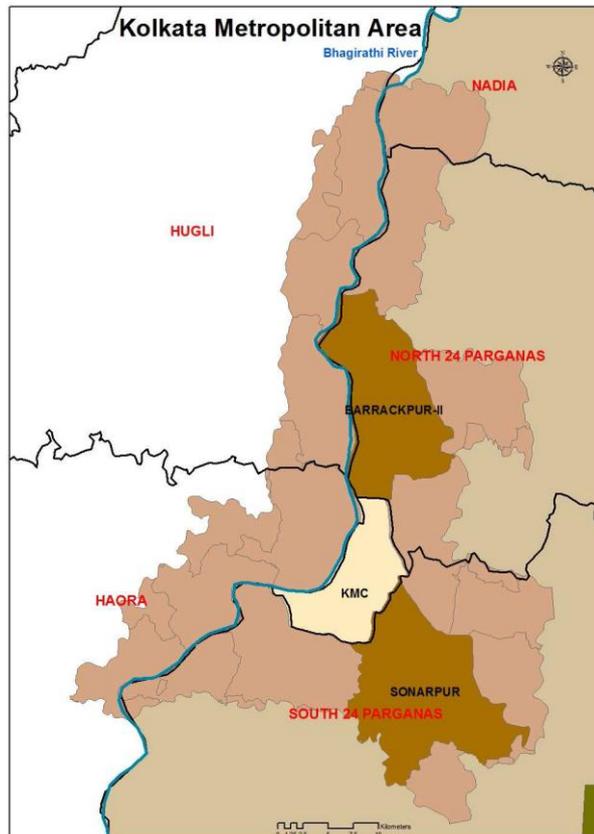
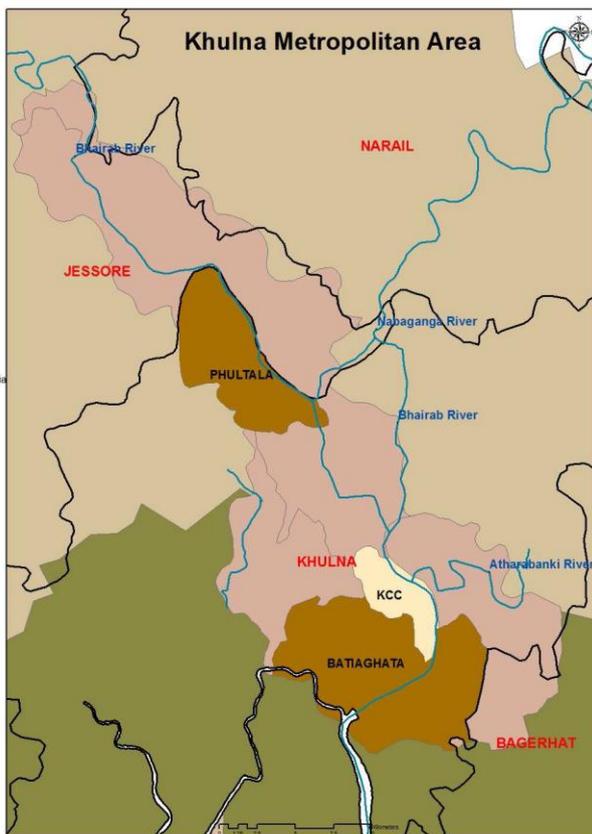
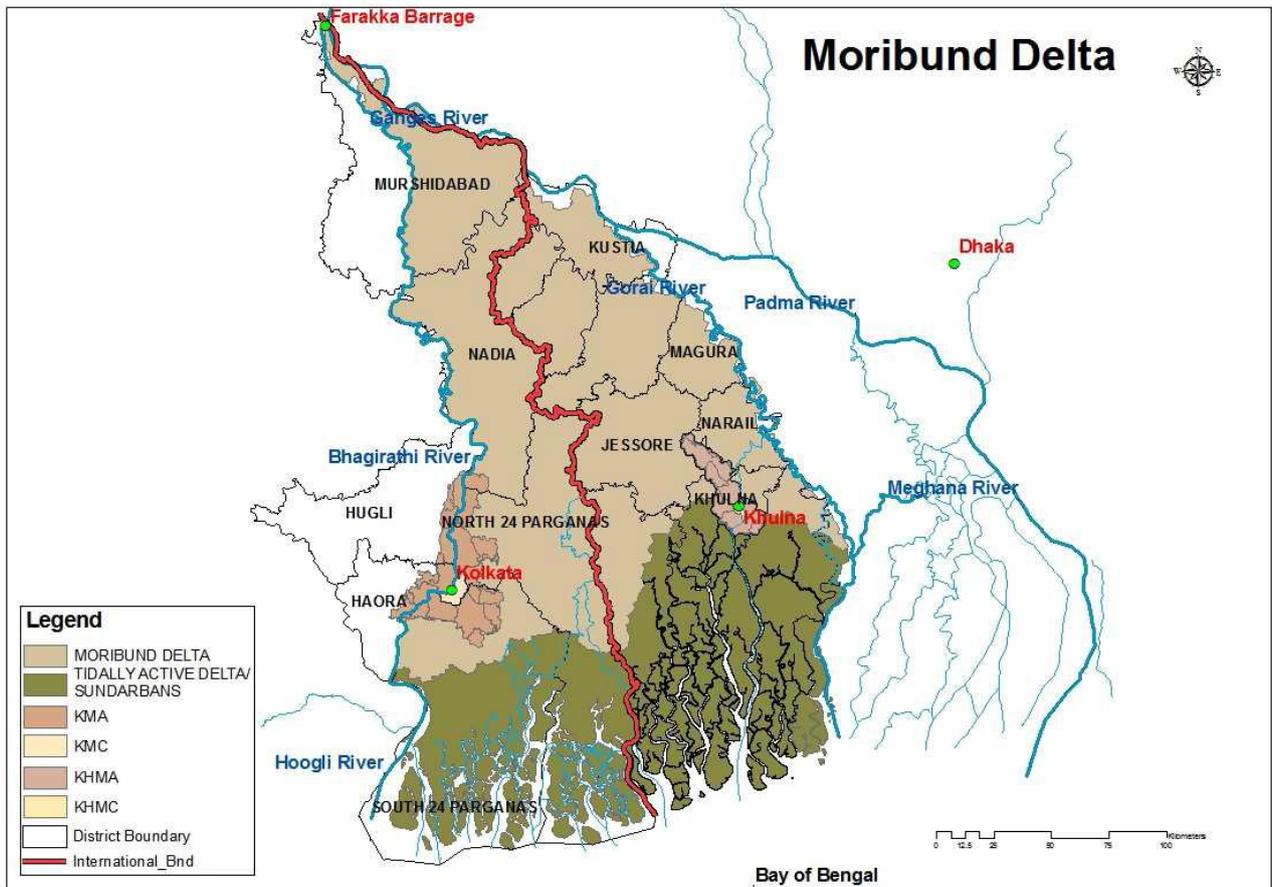
Current scientific understanding suggests principles and factors that underlie working institutions (e.g. Ostrom, 2005), but it does not translate into effective design approaches to support institutional transformation. Institutional arrangements are interwoven with so many social, physical and economic activities that it is impossible to design new working institutions that can be imposed on existing systems.

It is more likely that existing institutions are patched-up with new structures or transposed to perform new functions (Genschel, 1997; Cleaver, 2000; Merrey and Cook, 2012).

A key knowledge gap thus is how institutional development can be supported. This project addresses this knowledge gap through a mix of descriptive analytical research, drawing on different scientific disciplines, with action research. It uses research outputs to improve the design of process interventions. These are regarded as experiments that are to be carefully designed given the vulnerability of some of the actors involved, from which both scientists and local stakeholders can learn.

The research is based on case studies, with aforementioned case-sites around Khulna, Bangladesh, and Kolkata, India. Comparing sites in two countries located within the same Ganges delta system, where also local communities share an important part of their history, culture and livelihood patterns is expected to yield more insight in the influence of varying institutional systems. For each city, two peri-urban communities are selected for detailed analysis at the block-level. Selection criteria include their peri-urban nature (flow of goods and services and water between the rural and the urban), groundwater being a critical part of the system, contestation and conflict within and across sites, and promising research conditions (access to data, willingness of stakeholders). A preliminary scan suggested Phultala and Batiaghata blocks for Khulna and Sonarpur and Barrackpur II blocks for Kolkata (see Figure 1).

Figure 1. Location maps of Khulna and Kolkata in Ganges Delta, and local case study sites



Research questions

Five research questions are identified to guide this joint process of research and development in peri-urban communities around Khulna and Kolkata:

1. What is the availability of groundwater resources (both quality and quantity), and how has this changed with the onset of urbanization, climatic and other changes in the larger delta system?
2. How are available groundwater resources used to support livelihoods, and how has this changed over time with the onset of urbanization and other changes in the local environment?
3. How do institutions shape and structure groundwater appropriation and use, and how has this changed with the onset of the urbanization and other changes in the state and local environment?
4. What are key determinants of the interactions between various groundwater users that result from the above developments in groundwater resources, uses and institutions in peri-urban areas, and what are the outcomes in terms of sustainability, equity and productivity in the use of groundwater resources?
5. What are the possibilities to facilitate processes of negotiated institutional transformation that enable a sustainable and equitable use of groundwater resources?

Research framework

Figure 2 shows the key components for the integrated research, drawing on similar frameworks in literature on water systems governance (e.g. Loucks & Van Beek, 2005; cf. Ostrom, 2009). Three basic systems are recognized: a physical groundwater resource system, a socio-economic system, and an institutional system. The dynamic interplay between these three systems

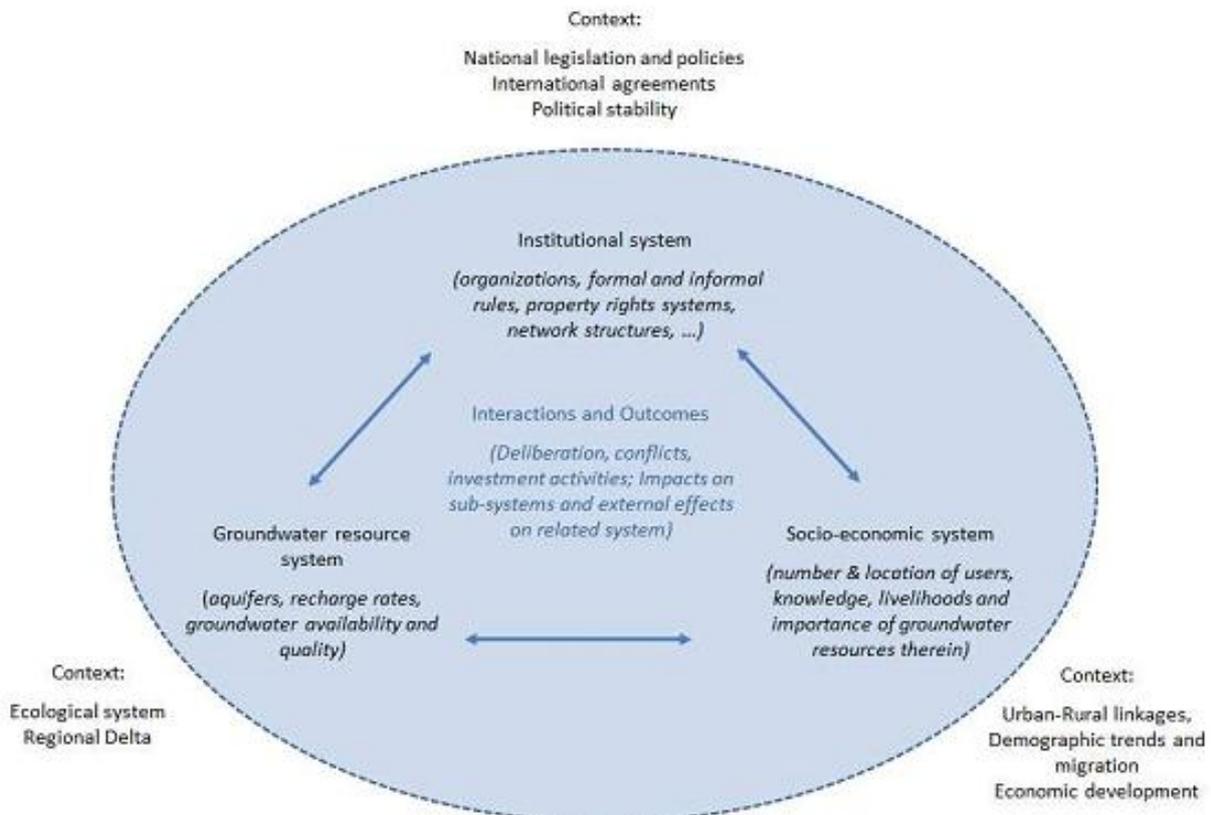


Figure 2. Key components for integrated research

determines the interactions among users, between users and resources, and the outcomes thereof. Furthermore, these systems interact with other systems. Important external influences derive from the presence of a nearby urban centre, which is an important user of groundwater and producer of pollution flows, but also a provider of livelihood opportunities. The larger delta system accounts for influences such as the river flows into the peri-urban systems, water logging and saltwater intrusion. Ecological conditions of relevance include increased climatic variability. At the state level, national demographic trends, policy developments and the economy interact with local level systems.

Integration across these three systems is key to understand the interactions of hydrogeological processes, institutional structures and socio-economic livelihood activities. Such integration takes place through the application of a certain theoretical perspective that allows for a meaningful reduction of complexity, ignoring certain elements and relations and highlighting others. When dealing with complex phenomena such as institutional development in peri-urban areas, a logical strategy is to use triangulation. Not only in terms of data collection, but even more so, in terms of the theoretical traditions and perspectives used for integration (Roe, 1998). Using the full strength of experience and capabilities available within the research consortium, three complementary angles for integration are applied: an index-based water poverty approach, a game theoretical modeling perspective, and a narrative analysis using grounded theory.

Activities

As social arrangements, institutions are the result of choices by each of the actors involved, and institutional transformations are, for an important part, the result of negotiation processes. Useful practical experience has been gained in past years with a negotiated approach to river basin management that balances traditional top-down decision making with bottom-up initiatives from, and decision-making by, local communities. These experiences have led to the identification of different structured tasks and activities for the facilitation of negotiation processes under the Negotiated Approach (Both ENDS and Gomukh, 2011). This provides a fruitful basis for the linkage of research and development activities, using and further developing the Negotiated Approach as a vehicle for more inclusive institutional transformation processes, in direct interaction with supporting scientific research activities. Given the ambitions of the project, this link between research, development and capacity building is critical.

This then, leads to different project activities, each interrelated but with a distinct focus:

Systems mapping and analysis:

1. Groundwater system mapping and impact assessment
2. Socio-economic system mapping
3. Institutional system mapping
4. Joint data collection activities for system mapping

Integration and Development:

5. Integration: Index-based, using a multi-dimensional groundwater poverty approach
6. Integration: Modeling, using a game theory approach
7. Integration: Narrative, using a grounded theory approach

Capacity building and Development:

8. Negotiated Approach: workshops and further development of the approach
9. Communication, knowledge sharing and cross-case learning

The activities are further described in Section 6. Below, we further explain the three integration activities that provide the link between research, development and capacity building in the project.

Integration: three complementary perspectives

The integration activities should provide a better understanding of interactions between systems and their outcomes, in order to eventually improve these outcomes. Key outcomes of interest are development and poverty reduction. The first integration activity looks at the linkage between access to groundwater, livelihoods and resulting incidences of poverty and vulnerability. The Multidimensional Poverty Assessment Tool (MPAT) proposed by the International Fund for Agricultural Development (IFAD) is used as a starting point (Cohen, 2009). It will be adapted into a Multidimensional Groundwater Poverty Assessment Tool (MGPAT), by enriching the MPAT with specific water poverty and vulnerability indices (e.g. Barua et al., 2012; cf. Hermans et al., 2005; Sullivan & Meigh, 2003). This index-based integration will result in a systematic assessment of various variables that are known to influence the linkages between groundwater, poverty and vulnerability of peri-urban water users. This shows where potential improvements are needed, and what the effects of modified or new institutions could be.

Scholars such as Ostrom (2005), Greif (2006), Scharpf (1997) study institutional development based on a view of mutually dependent actors and assumptions of (bounded) rationality. Game theory models are constructed to capture some of the essential interactions that determine how institutional rules combine with existing social and physical factors to produce outcomes of interest (see e.g. Ostrom, 2005; Greif, 2006; Lansing and Fox, 2011; Breeveld et al., 2013). Game theory models are fairly limited in scope but can help explain actor interactions and their outcomes. They also enable an analytical exploration of the possible effects of a change in rules or structures of the game (cf. Raiffa, 2002).

Previous experience suggests that the structure provided by game theory is helpful in the design of serious games that can be used to help build local capacity on negotiations (Hermans and Bots, 2002). Such serious games can offer a relatively safe environment for discussion and can help for instance to build understanding among actors by having participants play the roles of others (Bots and Van Daalen, 2007).

A third distinct and useful research tradition is rooted in more interpretive and narrative policy analysis traditions that draw on grounded theory and similar approaches (Glaser, 1992; Strauss, 1987). Qualitative data are closely recorded and coded in an iterative procedure, eventually resulting in holistic analyses that are described in a narrative form. These narratives lend itself to support a joint development of visions of past, present and future among stakeholders and researchers. For local level negotiation processes, this increases a shared cognitive and social fabric to build on in further developing institutional components.

(iv) Novel/original aspects

Knowledge and research

This project combines research and practice to address an important knowledge gap: how to support the further development of institutions that enable a sustainable and equitable management of natural resources. It does so for the novel phenomenon of peri-urban areas, for which science and policy-makers still have to develop adequate frameworks. It explicitly looks at groundwater resources. In contrast to surface water, governance mechanisms that will improve groundwater justice and enable sustainable groundwater management have received little attention both in India and Bangladesh. Also the current experiences with the Negotiated Approach do not extend to the area of groundwater management.

Sustainable development and Capacity development

The analytical activities are explicitly designed to enable participatory assessments, in which local actors can be engaged and reflect on their own processes of interaction and institutional transformation.

Important gains will be obtained from combining existing frameworks for intervention (the Negotiated Approach) with novel supporting tools: game theory and serious gaming, multidimensional assessments and narratives that support joint sense making. In this project we intend to contribute fairly simple "shoestring" approaches, using simple formats and

approaches that lend themselves for replication in other environments. These approaches are developed in interaction with local stakeholders, including peri urban water users, small local enterprises, local government officials and state level policy-makers; These groups do not regularly engage with each other in a constructive dialogue as of yet. Their involvement in the project will help build future capacity to continue such dialogues and extend them to other areas.

2. Policy relevance

The workshops conducted in support of proposal writing for this project in Dhaka, Khulna and Kolkata have reaffirmed its relevance. A known constraints in the cases of Khulna and Kolkata, is the ineffectiveness of many of the formal rules, regulations and policies, in governing access and use of groundwater resources. Permit and spacing systems are in place in both Khulna and Kolkata, but their implementation and enforcement is difficult. This recognition among stakeholders about the ineffectiveness of the existing and recent formal rules and regulation offers a good basis to turn their attention to the unique challenges of peri-urban contexts.

The research undertaken will help to identify different possible configurations and feasible pathways for a more sustainable use of resources by various competing users. These insights and serious gaming workshops will help government officials and professionals from NGO's to be more aware of needs and concerns of local communities, and of possible institutional structures that help achieve a fair balance between the needs and interest of peri-urban groundwater users and the urban water consumers.

Furthermore, project activities are explicitly designed to enable participatory assessments, in which local stakeholders can be engaged and reflect on their own processes of institutional transformation. The use of a tool like serious gaming for developing negotiation processes is part of this, and will help to support negotiation processes and similar participatory learning activities in a range of other communities, both in the target countries as well as broader internationally. By explicitly linking the research process and findings to increasing the capabilities of groundwater stakeholders to arrive at collective understandings on how to design and implement approaches that will lead to sustainable groundwater governance, the proposed research will make a major contribution to both society and science.

Multiple letters of support and active participation of many different stakeholders during the workshops attest of the strength of existing links with policy and practice. A wide range of these actors shall be engaged through the life-cycle of the project. These include representatives of government and state agencies, but also private enterprises and civil society organizations that have a potential to influence policy change through advocacy. Some of these actors have already participated in the consultation workshops and look forward to further engagement. In the design of the activities, first activities with separate stakeholder groups are undertaken, to prepare the ground for dialogue, followed by joint workshops and cross-case learning activities.

The project tools and methodologies developed to support negotiation and capacity building processes in groundwater governance are likely to be also helpful for negotiation processes in other areas, beyond groundwater management. The relevance of the project for policy making in other countries and contexts is further explained in Section 4.

3. Process management and M & E strategy

Decisions on project activities and their adaptation and implementation are made by a project committee in which all consortium partners will have a representative, chaired by the representative of TU Delft. An executive board, consisting of the overall project coordinator from TU Delft and the Southern project coordinator from SaciWATERS, will provide periodic updates to the project committee. A Project Advisory Group (PAG), consisting of external

members, will be asked on an annual basis to review project results and plans. The PAG also will offer support on strategic issues around policy and advocacy, government linkages and opportunities for external collaboration. The PAG will meet at least once a year, but if necessary will organize special meetings as per the project's strategic needs. For further details, please refer to Annex 7(PAG).

A project inception workshop is planned in Kolkata early on in the project, aimed at coordination among project staff, and to further develop good working relations with partners and stakeholders. This project inception workshop will be followed by annual project meetings, alternating between countries. Stakeholders will be involved from the start in project activities through pre-scoping interviews that are used to further refine the project design during the first few months. More visible workshops aimed at capacity building and development with local stakeholders and policy-makers are started in year two and are then organized on a regular basis to keep momentum in the process.

An important assumption is that research activities and outputs can be used for the (improvement of the) Negotiation Approach interventions. Testing this assumption, which is visualized in the project's Theory of Change, requires careful monitoring and evaluation (M&E). Hence, M&E serves not only purposes of process and project management, but is also an essential element for collaborative learning and action research in the project.

Establishing impact of project activities requires a baseline assessment prior to the intervention. This baseline assessment will be undertaken in a participatory way, for which a pre-scoping assessment will provide useful inputs. Combined with the project's Theory of Change, this baseline assessment will be used to assess progress and impacts of project activities and their (intermediate) results. More classic formats will be combined with novel participatory techniques, such as the use of short video interviews (2-3 minutes) with stakeholders. These M&E activities will be used to fine-tune the design of project activities, to track progress of project implementation and, as stated, to test the correctness of assumptions underlying the project's Theory of Change.

To close the learning loop, knowledge and lessons from the project will be shared and discussed during two larger cross-case learning workshops. During these workshops, one after about two years, and one near the end of the project, project staff and stakeholders will reflect on project progress and results. The midterm findings will form the basis for possible strategic adjustments in the project's approach, while the final evaluation will ensure the capture of lessons learnt through the experiences of the program.

4. International linkages, embedding and outreach

The project connects well with international policy initiatives that look into peri-urban areas (e.g. FAO, 2012) and groundwater governance (e.g. GEF et al., 2013). Links with the 'Water Mondiaal' programme, and the 'Delta Alliance', which will play a large role in the Knowledge 2 Knowledge component of the Water Mondiaal programme in Bangladesh, have been established by southern partners and will be used to undertake comparative learning. Links with the recently started Dutch water sector funded "Blue Gold" programme in Southwest-Bangladesh will be utilized to leverage more local impacts as well as to share lessons (see Letter of Support). Similarly, existing links with donor-funded projects such as 'Fresh water buffering in coastal lowlands', World Bank funded Bangladesh Rural Water Supply and Sanitation Project, Water Management Improvement Project and Coastal Embankments Improvement project will be utilized.

The project connects well with the Dutch funded Bangladesh Delta Plan process that is currently being initiated. Groundwater management and water governance in peri-urban areas are likely to be important components in those Delta planning processes. In India, links exist with an IUCN-IWMI project regarding the impact of the Groundwater Act on electricity use and agricultural production in West Bengal.

An effective and enduring link to practice and policy is forged through the presence in the project consortium of organizations that have a long history of engaging with local stakeholders and government organizations in the shared management of water resources. In the field of advocacy on water management and the Right to Water and Sanitation and Hygiene, Both ENDS with the Bangladesh WASH Alliance has had regular contact with the Dutch Embassy in Dhaka and the Ministry of Foreign Affairs.

Through Both ENDS' international network of Civil Society Organizations (CSOs) it is possible to link the results of this project worldwide. SaciWATERS, the consortium's lead institution in South Asia, has built a track record of strong networking in South Asia over the last ten years. It has a visible and strong presence in the region and has made a major dent on reorienting the dominant paradigms in water management and education from a technocratic, positivist focus to one emphasizing the integration of the technological with the social, political and ecological aspects of water use and access. By partnering with BUET-IWFM in Bangladesh, it has created a niche already for challenging unsustainable patterns of water use and creating a demand for alternative institutional mechanisms. Outreach will be further sustained through the involvement of CSOs and media.

Project results will find their way to an international audience through the courses offered at TU Delft, BUET and MDI. The MSc degrees offered at TU Delft increasingly cater to an international student market, while further dissemination is ensured through the use of Open Course Ware and internet-based learning platforms. Also, close ties exist with UNESCO-IHE, Deltares, with institutes in India, Singapore and China, and with leading US-based research institutions, for instance through the Technology, Policy and Management consortium that includes TU Delft, MIT, and Carnegie Mellon University.

5. Up-take of IAC comments

The consortium is grateful for the supportive comments of the IAC and the useful suggestions made. In particular we have sought to improve on three key aspects based on the IAC comments: Integration, Stakeholder demand and Policy linkages.

Integration

The project's strategy for integration has been elaborated through the specification of three integration activities that link integrative research, development and capacity building.

Stakeholder demand

The stakeholder consultations confirmed the initial estimation of stakeholder demand, both at local and national level, and both from local users, as well as public sector policy actors. Stakeholders for instance signaled a lack of knowledge about the groundwater system in relation to assessing boundaries of safe groundwater extraction. Also, they expressed the difficulties with the peri-urban areas as dynamic shifting areas, that fit neither the official urban nor the rural administrative categories. Furthermore, there was wide support for the negotiated approach activities. This includes various local enterprises, confirmed in letters of support.

Policy linkage and impact pathways

Presumed impact pathways for change are visualized in the project's Theory of Change that was developed based on stakeholder workshops. A key part of setting in motion further institutional developments is the involvement of local and state level policy-makers and planners. During proposal development, we prepared the ground for active involvement of these public sector parties by involving and consulting local and state officials in Dhaka, Khulna and Kolkata. Please also note the letters of support of policy actors.

6. Description activities performed by project staff

Activity 1

Title of project:	Groundwater system mapping & impact assessment	
Name project staff member:	PhD-1 (to be hired by BUET)	
Name supervisor/advisor:	Dr. M. Salehin, Dr. M. Shah Alam Khan	
Start and end date activity:	Yrs 1 – 4	
Research School:	BUET, Institute for Water and Flood Management	
Discipline/Skills(s):	Hydrogeology, modelling, GIS	
Description:	<table border="1"><tr><td>Word count: 499</td></tr></table> <p>The objective of this activity is to get an insight into the present situation of the complex, fragmented and composite groundwater aquifers in the study area in terms of quality and quantity and to assess the impacts of natural and anthropogenic influences under different scenarios.</p> <p>The detailed hydrogeologic analysis will encompass two regions: Kolkata and Khulna, particularly the specific case study sites identified for this project. The regional hydrology in the Ganges delta will be assessed from a historical perspective of deltaic evolution and developmental interventions in order to get a clear understanding of the similarities and differences in the hydrogeological settings and groundwater –surface water interactions.</p> <p>The major components of the activity include: (1) data collection; (2) preliminary hydrogeologic analysis; (3) scenario development; (4) groundwater flow/ solute transport modelling for impact assessment.</p> <p>Data will be needed on lithology, historical groundwater levels, groundwater quality (salinity, arsenic), abstractions for drinking water, irrigation, aquaculture and industrial use, climate (rainfall), river water level, etc. The Indian part of the data will be collected from Water Resources Investigation and Development Department, State Water Investigation Directorate (SWID), the Central Groundwater Board, and minor irrigation census reports. The Bangladeshi part of the data will be collected from Bangladesh Water Development Board (BWDB), Department of Public Health and Engineering (DPHE), and Bangladesh Agricultural Development Corporation (BADC). A number of primary measurements of water quality will be done to get sufficient details in the study sites. Additionally, people's perception on groundwater availability and quality to be obtained from a joint household survey (Activity 4) would be useful.</p> <p>The collected data will be analyzed for seasonal/ historical changes in groundwater levels, trend analysis, and spatial distribution of groundwater use and quality, and for estimation of groundwater recharge and storage, and delineation of aquifer systems (using RockWorks software).</p> <p>Scenarios will be developed based on current and future groundwater abstractions, urbanization, and climate change (e.g. changes in rainfall and sea-level rise). Scenario development will essentially involve cooperation with the other activities in particular with regard to water demand and groundwater use. Groundwater flow models will be set up in MODFLOW for the study sites. A three-dimensional variable-density groundwater solute transport model, SEAWAT will be used to simulate salinity. The models will allow assessment of the responses of groundwater systems to possible natural and anthropogenic changes.</p> <p>The outputs from each of the sub-activities can be summarized as follows:</p> <ol style="list-style-type: none">(1) A data base for aquifer delineation in terms of quantity and quality, and for setting up the groundwater flow/solute transport models(2) Mapping of aquifer systems in the study areas in Kolkata and Khulna; mapping of salinity and/or arsenic distributions in the aquifer systems.(3) A number of scenarios in terms of natural and anthropogenic drivers of change at regional and local levels.(4) Groundwater flow/transport models and assessment of aquifer storage, recharge and responses of aquifer systems to different stresses. This will provide useful insights into the physical dimension of groundwater security in the two study areas in Kolkata and Khulna.	Word count: 499
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Activity 2

Title of project:	Socio-economic system mapping		
Name project staff member:	Dr. Poulomi Banerjee, Partha Sarathi Banerjee, ATM Zakir Hossain		
Name supervisor/advisor:	Dr. V. Narain / Dr. A. Prakash/Dr. L. Hermans/Dr. S.A. Khan		
Start and end date activity:	Yr 1 & 2		
Research School:	SaciWATERS / TU Delft / BUET		
Discipline/Skills(s):	Social geography, livelihoods analysis		
Description:	<table border="1"><tr><td>Word count:</td><td>467</td></tr></table> <p>Groundwater resources cater to various societal and ecological needs and provide important resources for the local water-based livelihoods. In the areas around Khulna and Kolkata, shallow groundwater aquifers are extensively used for irrigation and fresh water aquaculture. Increasing pressures on already strenuous groundwater tables fume conflicts in resource sharing and affect the livelihoods of the vulnerable, pushing them further down the poverty ladder. With this understanding the sub project will map groundwater use for livelihood activities as well as conflict and cooperation among users, with specific attention for managing groundwater insecurities. This will be done for the peri urban sites of Kolkata and Khulna, taking into account the proximity of an urban center and the rural-urban linkages.</p> <p>The socio-economic system mapping activities will be based on eisting approaches for sustainable livelihoods analysis and water poverty analysis. In particular, the Multidimensional Poverty Assessment Tool (MPAT, see Activity 5) will be used to develop a framework for the mapping activities. The following sub-activities are foreseen:</p> <ol style="list-style-type: none">Develop a framework for household questionnaires and checklist following the components of the Multidimensional Poverty Assessment Tool (see also Activities 4 and 5). The design will be informed by results of a pre-scoping assessment and is likely to cover six thematic components; Use(livelihood) and accessibility, Conflict and cooperation, Waste management measures, Education and awareness, On-farm and non-farm assets Gender and social equality.Data collection, jointly with other Research mapping activities, through a household survey, focus group discussions and key informant interviews (see Activity 4).Preparation of survey data in data files for further analysis (Activity 5)Document local histories, perceptions and experiences of scarcities, livelihood insecurity and vulnerability; of peri urbanization and groundwater status at delta context.Focus group discussion, key informant interviews, direct observations and walk-throughs will be used to capture adaptive strategies of the peri-urban communities towards effective groundwater management.In depth case studies on disputes and conflicts about access and sharing of ground water across sectors. <p>These sub-activities, will require expertise with social science research, available at SaciWATERS. It will be executed primarily by the Post Doc employed at SaciWATERS, with close supervision and coordination of senior researcher(s) and project staff at each study location during the first two years of the project. The household data generated will be used as a direct basis for Activity 5 (integration by index method). Information on groundwater use feeds into the groundwater modelling scenario's, and insights on groundwater use and disputes will offer essential inputs for the game theory integration (Activity 6). In addition, a comparative perspective at the local and regional level will be produced. Such a comparative perspective would provide an opportunity for identifying what can be learned from different contexts and using new insights in proposing informed interventions towards ground water-secure and resilient peri-urban communities.</p>	Word count:	467
Word count:	467		

Activity 3

Title of project:	Institutional system mapping
Name project staff member:	PhD 2 (TU Delft); Partha Sarathi Banerjee, ATM Zakir Hossain
Name supervisor/advisor:	Dr. W. Thissen / Dr. L. Hermans
Start and end date activity:	Yr. 1 & 2 (see Activity 4 & 5 for other PhD-2 activities)
Research School:	TU Delft, Department Multi-Actor Systems
Discipline/Skills(s):	Institutional analysis, policy analysis
Description:	Word count: 500

This research activity maps the relevant institutional context, to see how existing rules and social arrangements shape and structure access to groundwater in peri-urban contexts, how they have changed and evolved with the onset of the urbanization, and where there are opportunities to support further change in directions that support sustainable and equitable use of resources.

Institutions are mapped based on a view of institutions as formal and informal rules, norms and organizations that shape patterns of social behaviour among groups of actors. Formal and informal institutions are investigated, for the current situation as well as for an earlier stage to trace changes and dynamics. Institutional systems will be mapped broadly, in a way that enables integrative activities from different perspectives. Survey-based indicators will therefore be combined with information obtained from focus-group discussion, key informant interviews and archival records (see Activity 4). This will cover both government sources as well as local community representatives (various users and fora, incl gender and social stratification, occupation etc.).

This Activity comprises of the following components:

- i. A pre-scoping assessment to further design data collection and analysis
- ii. Data collection (jointly with other activities, see Activity 4):
 - a. Mapping of formal government institutions: legal framework (existing directives, acts, etc), prevailing policies and plans, the administrative set-up in terms of the tasks and mandates of organizations at various levels and sectors, and other efforts at regulating groundwater use (spacing norms, local permits, credit restrictions,...)
 - b. The mapping of informal institutions: local norms on groundwater access, local forms for groundwater allocation including water markets (and terms of transaction – cash, produce, diesel, labour,...), conflict resolution practices and forums (statutory and non-statutory), and the role of social capital (especially the relational/network part of social capital: among users, between users and bureaucracy, between communities).
 - c. Specific attention is given to the links between land-tenure and access to groundwater, the social differentiation and safeguards in institutions for equity (gender, poor and vulnerable groups, urban/peri-urban/rural) and sustainability, and the implications of the peri-urban context (e.g. lack of clarity about prevailing rules, changes due to rapid developments, different bases of legitimacy, competition for authority among actors)
- iii. Institutional analyses:
 - a. Institutional analysis, emphasizing known variables and linkages in institutional development, using neo-institutional framework (e.g. IAD/SES frameworks Ostrom)
 - b. Institutional analysis emphasizing the evolutionary and emergent character of institutions (e.g. Cleaver), using a grounded theory approach in coordination with Activity 7.
- iv. Preparing case reports / working papers for Kolkata and Khulna, which will include a description of relevant developments in the broader institutional context surrounding these local sites. These reports provide the basis for the preparation of a further academic publication on institutional dynamics in relation to groundwater management in peri-urban areas.

Some of these components show potential overlap with the socio-economic mapping activities. To avoid duplication of efforts, data collection activities are jointly managed (see Activity 4).

Within the project, the institutional mapping activities will provide key building blocks for all three integrative activities and the implementation of the negotiated approach.

Activity 4

Title of project:	Joint data collection for system mapping
Name project staff member:	Poulomi Banerjee, PhD1, PhD2, Partha Sarathi Banerjee, ATM Zakir Hossain
Name supervisor/advisor:	A. Prakash, M. Shah Alam Khan, L. Hermans,
Start and end date activity:	Yrs 3-4
Research School:	SaciWATERs, BUET, TU Delft
Discipline/Skills(s):	Survey design, participatory research (FGD, interviews)
Description:	Word count: 392
<p>The project features three research mapping activities that each have their own distinct focus, yet also have some overlapping areas. Data to feed into these assessment will come from archives and records, but also additional collection of primary data will be necessary. In order to ensure an efficient use of project resources, as well as of time and efforts of local stakeholders and key informants, data collection activities for will be coordinated.</p> <p>In this way, Activity 4 can be seen as a sub-activity to Activities 1, 2 and 3, Yet, to emphasize the importance of coordinated data collection, joint data collection has been formulated as a separate project activity. The following sub-activities are foreseen, during the first project year:</p> <ol style="list-style-type: none">1. Pre-scoping assessment, also mentioned under Activities 2 and 3. A pre-scoping study, looking into what is known about the three systems (groundwater, socio-economic, institutions). Available literature and results from the project pre-consultation activities will be complemented by a small number of key informant interviews (KII) and focus group discussions (FGD). The latter will be used among others for participatory analysis that support stratified random sampling during data collection (such as a participatory wealth ranking exercise). This pre-scoping should inform the further design of data collection efforts (household survey and semi-structured interviews and group-discussions)2. Data collection design – The pre-scoping assessment will be used to identify key indicators and sub-components for the design of the household survey. This survey design will be based on the MPAT format (see Activity 5), but complemented with questions that address specific groundwater issues as well as institutional factors not covered in MPAT. The advantage is that the MPAT survey design covers many of the indicators of interest here, and has been tested and used already. Household surveys will be complemented with more qualitative approaches (FGDs, KII).3. Enumerator training and survey practice sessions (also to fine-tune survey design).4. Administering household surveys – MPAT surveys are generally administered as short interviews, taking approximately half an hour per household (Cohen, 2009). Approximately 200-300 questionnaires are to be administered, at both sites. Administration by enumerators will be coordinated by the local level partners JJS and The Researcher. Similarly, FGDs and KII will be held in parallel with household survey. <p>Formatting data for analysis, preparing data reports and basic Excel files for further use by the various mapping and integrative activities.</p>	

Activity 5

Title of project:	Integration using an index-based approach
Name project staff member:	Poulomi Banerjee
Name supervisor/advisor:	A. Prakash, M. Shah Alam Khan, L. Hermans,
Start and end date activity:	Yrs 3-4
Research School:	SaciWATERs, BUET
Discipline/Skills(s):	Water poverty assessments (multi-dimensional)
Description:	Word count: 397
<p>The study will develop a Multidimensional Ground Water Poverty Assessment Tool (MGPAT), an adapted version of Multidimensional Poverty Assessment Tool (MPAT). MPAT is a tool developed by an international team of experts supported by the International Fund for Agricultural Development (IFAD) for integrating status information on physical, social and institutional systems (Cohen, 2009). It provides a holistic tool to establish direct link with the policy makers by making them understand the shortcomings and set priorities. The extension of this tool is suggested to keep groundwater at the focal point.</p>	

The multidimensional groundwater poverty assessment is expected to cover nine key components identified as crucial for the need of the groundwater assessment. The information on these key components will be derived from the different systems mapping activities earlier in the project:

- Groundwater availability and quality
 - Exposure and resilience to shocks
- } Hydrogeological mapping
- Use(livelihood) and accessibility
 - Conflict and cooperation
 - Waste management measures
 - Education and awareness
 - On-farm and non-farm assets
 - Gender and social equality
- } Social mapping
- Groundwater governance
- } Institutional mapping

Sub activities:

- i. Identification of 3-4 sub components under each of the above mentioned key thematic components. They will be identified in the scoping study during the project initiation phase.
- ii. Assigning relative weightages to each of these sub components. Analytical Hierarchy Process (AHP) will be used to assign a weightage. AHP is a multi-criteria decision-making tool established by Saaty (2003) to analyse multiple aspects simultaneously. AHP involves four steps – pair-wise comparison; preparation of the comparison matrix; deriving the priority vector; and lastly calculating the consistency ratio. The responses to calculate weights are collected through FGD and KII with experts and representatives of the block.
- iii. The weights will then be combined with the actual data collected through household surveys on sub-components using the methodology of MPAT (www.ifad.org/mpat/resources/userpdf). This will be followed by aggregation of data on sub-components of each of the 9 themes.
- iv. The results of the MGPAT analysis will be expressed as percentages where a relatively lower percentage reflects poor status of the block in the particular component or theme. This process bridges the communication gap between various stakeholders and generates information for designing demand-driven interventions.

Outputs include quantified thematic indicators and indices for Khulna and Kolkata and identified variables that are crucial for prioritization and negotiation under specific scenarios. This information will be used as part of negotiated approach activities to inform and facilitate discussions among stakeholder about focal areas for change.

Activity 6

Title of project:	Integration using a game theory approach
Name project staff member:	PhD-2 (TU Delft)
Name supervisor/advisor:	L. Hermans, E. van Daalen, R. Kempers, A. Prakash, M. Shah Alam Khan
Start and end date activity:	Yrs 3-4
Research School:	TU Delft
Discipline/Skills(s):	Game theory/Actor modelling, Serious gaming
Description:	Word count: 454

This activity will look at interactions among actors that result from the combined characteristics of geophysical, livelihoods and institutional subsystems in peri-urban communities, and their consequences in terms of equity and sustainability of groundwater use. This is done through the construction of game theory models.

Using the outcomes of previous system mapping activities, possible situations to model will be identified. For every site, at least one model is constructed (i.e. minimum four in total). Likely situations are observed patterns of conflicts or unsustainable practices that result from regular patterns of interaction, often presumed to be at least in part due to a lack of

cooperation and coordination among key participants. Identification of situations for game theory modelling will be done using socio-economic and institutional mapping results, and will be done with an eye to usefulness in support of negotiated approach activities with local stakeholders and government representatives.

Game theory models will be constructed for the selected situations for at least two moments in time. This allows for the identification of changes in context or rules that may have changed the incentives or resources for actors in their play of the game, showing a shift in outcomes. Formal game theory models will be constructed, which lend themselves for further quantification. Detailed quantitative analysis, however, is not necessarily part of this activity, as past experiences show that there are useful ways to analyse the actor interactions also based on purely qualitative or semi-quantitative models.

Models that are constructed can help explain how situational characteristics, especially rules-in-use, biophysical and community characteristics, result in (un)desirable outcomes. This insight can be used to design serious games to support understanding among stakeholders of the drivers between group interactions and to open the way for discussions of possible improvements. To fulfil a useful role in the negotiated approach, the essence of the game theory models should be fairly simple to grasp, should be realistic but not overly realistic, to preserve a safe environment for learning and debate. Furthermore, it often helps to use role-playing, asking participants to assume the roles of other parties in a conflict or debate. The application of serious games for mediation purposes has been reported in the past (see Bots and Van Daalen, 2007) and could be supported and structured using game theoretical models. These models enable the development of serious games whereby the consequences of individual choices, optimized for individual benefits, result in altogether undesirable outcomes. Experience with such games also shows that they can help participants see that quite often, Pareto-optimal solutions that are feasible through cooperative efforts, are not reached in non-cooperative situations. Game theory models, incorporated within serious games, can help to explore the effects of possible new rules or agreements among parties.

Activity 7

Title of project:	Integration using a grounded theory approach
Name project staff member:	Dr. V. Narain, Dr. Poulomi Banerjee
Name supervisor/advisor:	A. Prakash, M. Shah Alam Khan, W. Thissen, L. Hermans,
Start and end date activity:	Yrs 3-4
Research School:	MDI, SaciWATERs
Discipline/Skills(s):	Grounded theory, narrative policy analysis
Description:	Word count: 484
<p>Grounded theory is an approach to theorise about social phenomena based on empirical insights. It relies on the premise of analytic generalization, which involves an effort to draw theoretical and conceptual insights based on the study of social phenomena and processes. As against the other two integration approaches, analytic generalization goals are more explicitly theoretical and conceptual.</p> <p>The grounded theory approach will be used in the project to contribute to the development of a theoretical framework that helps us understand the nature of groundwater appropriation processes in peri-urban contexts and their interface with social and institutional systems. While the preliminary conceptual framework guiding this study has already been developed in the proposal, will serve as a starting point to guide our research, empirical insights generated in this research shall be used to refine these.</p> <p>Much of these insights shall come through the direct interface with and observation of the communities being researched, the processes of negotiation and articulation, the study of the strategies employed by water users to defend and reinforce their claims on water and the examination of the social and institutional mapping. Grounded theory works through a process of developing codes and concepts to capture the key phenomena observed. The qualitative data generated in the course of the fieldwork shall be stored, saved and classified using key concepts. This process of coding or developing key concepts shall take place at several levels or layers. Once the key concepts and codes are developed, relationships across these shall be drawn. Through this process of identifying the relationships, the process of theorization shall take place.</p>	

Given that the grounded theory approach shall be used basically as a tool for integration, this shall be used mainly towards the last phase of the project, when the synthesis shall take place, looking at the relationship across the ecological, social and institutional contexts. However, grounded theory works on a premise of iteration and improvisation. There is a circular – rather than linear – process of going back and forth between the data and the theory and concepts. This means that the efforts at grounded theory will start relatively early in the research, by looking at the qualitative data generated, supported by developing key concepts or constructs. This would require a persistent effort at closely recording and storing the qualitative data, using it to structure subsequent field visits and investigating issues of groundwater appropriation and use.

Through a process of immersion in the data, the grounded theory approach will be used to describe through a narrative the relationship and interface of the social, ecological and technological context of groundwater use in peri-urban contexts. These narratives offer a more holistic account of the developments and interactions that shape outcomes of (un)sustainable groundwater use and groundwater (in)security. Through this narrative format, these accounts lend themselves for discussion during negotiated approach workshops, where they can help establish a shared language and story among participants.

Activity 8

Title of project:	Negotiated Approach - Capacity building and Development
Name project staff member:	R Kempers, M Chisty, M Binoy, PhD-2
Name supervisor/advisor:	ATM Zakir Hossain, Partha Banerjee, L Hermans, E van Daalen
Start and end date activity:	Yrs 1 – 4
Research School:	TU Delft
Discipline/Skills(s):	Community development, negotiations, conflict resolution, communication, serious gaming

Description:

Word count: 499

Capacity building and development are partly integrated in the research stream and on-the-job training of project staff. Additional activities will be centered around the Negotiated Approach. Since 1992, Both ENDS has supported inspiring forms of participatory and sustainable Integrated Water Resources Management in Costa Rica, India, Mexico, Peru, South Africa, Bangladesh and Indonesia. From these concrete experiences, the Negotiated Approach (NA), was developed, focusing on community empowerment, knowledge development, and institutional development.

Both ENDS is already planning a larger upscaling of existing NA- activities with partner organizations in Bangladesh. An MSc-intern from TU Delft is starting at Both ENDS to explore the development of serious gaming as a new tool for the Negotiated Approach.

The foreseen activities comprise the following components:

1. Preparatory activities, including the pre-scoping assessment and project inception workshop, to further design activities (year 1)
2. A first series of workshops to introduce the Negotiated Approach and to establish a basis for further activities, early in year two:
 - a. Local workshops: Needs assessments, gaps assessments, knowledge transfer based on preliminary research results. To facilitate a gender-balanced involvement, women and men will at first be involved separately for half a day. During the second part, local government officials will be involved as well.
 - b. A workshop focusing more on institutions and government, with strong participation of government officials: inception, assessment, gaps, knowledge transfer
3. A combined workshop between local stakeholders (community and policy-makers) and state level government officials, for joint baseline determination and agreement on principles for further proceedings. This should ensure a shared understanding and continued willingness to engage in dialogue between local and state level actors. Contributes to policy uptake.
4. A first learning and reflection workshop, coinciding with the project's mid-term assessments. Bringing together selected representatives from Khulna, Kolkata and

<p>Dhaka, to exchange experiences and gain new ideas for further actions and promising avenues.</p> <p>5. Two workshops aimed at capacity building and training, using serious gaming to illustrate how different actors interact in producing groundwater outcomes, and to simulate negotiation processes. Furthermore, part of these workshops will use insights gained to formulate groundwater demand and use scenarios.</p> <p>6. A joint workshop bringing together local and state level stakeholders, e.g. to discuss research findings and translate them into further negotiation activities</p> <p>7. Exit workshops, taking stock of results and changes achieved, and outlining a process to continue negotiations and dialogue beyond the project's timeframe.</p> <p>As result of the series of workshops we expect to reach the following outcomes:</p> <ul style="list-style-type: none"> • Local communities are capacitated and better informed about long term groundwater security, leading to improved livelihoods. • Local and national government institutions are reoriented effectively in a way that enables long-term groundwater management in an equitable and sustainable way. • Local communities have their own say about local groundwater access and use in consultation with local government. • The research team has learned about improving the Negotiated Approach in areas of groundwater management, as well as about the effectiveness of simple serious gaming exercises and additional tools in LDC contexts

Activity 9

Title of project:	Communication, knowledge sharing and cross-case learning.
Name project staff member:	All
Name supervisor/advisor:	W. Thissen / A. Prakash
Start and end date activity:	Yrs 1 – 4
Research School:	Not applicable
Discipline/Skills(s):	
Description:	Word count: 490
<p><i>Project communication and cross-case learning</i></p> <p>To ensure adequate coordination between the project partners a website will be set up, while dropbox facilities will be used for internal communication and coordination, supplemented by face-to-face meetings of key project partners. See also section 5-c (Process Management and M&E strategy).</p> <p>Dedicated meetings and workshops will be held in the two countries and regions, as described for the Negotiated Approach (Activity 8). Dialogue and learning across policy levels is supported by engaging a number or state level representatives also in local stakeholder workshops and vice versa. Furthermore, at two moments, international exchanges of a small number of case site stakeholders are foreseen. This should help to foster cross-case learning and cross-national dialogue and should ensure that lessons from both cases are drawn, discussed and shared.</p> <p>A project website will be established that facilitates (two-way) communication with stakeholders and the broader communities. Key research (interim-) findings will be posted, and reactions and discussions solicited through use of social media and twitter. Key findings will be reported in concise policy briefs written in lay-person's language, for broad distribution, accompanied by press releases and possibly interviews for uptake by regional and national media.</p> <p><i>External knowledge sharing</i></p> <p>In support of both project activities and knowledge sharing, bilateral contacts have been established with local research institutes and universities in Khulna and Kolkata (see Annexed Letters of Support). Possibilities for synergies, collaborations and knowledge sharing with ongoing projects and networks are actively pursued, such as with the Blue Gold programme, CAP-NET, the Bramaputra Dialogue, The people's network DRR&CC, and other projects (see Letters of Support). All these projects work on issues of (ground)water governance and community engagement. Also, established contacts with the Netherlands' Embassies in Dhaka and Delhi will be maintained for further support in this respect.</p>	

Within the UDW programme, it is likely that several projects will be working in the Ganges Delta, and possibly also in the Southwest area of Bangladesh. Once the selection of projects is known, the consortium partners will engage with the other projects where academic and practical overlapping interests seem apparent, to exchange experiences, explore opportunities for joint activities and for the organizations of e.g. joint thematic sessions at international conferences and workshops. Current collaborations with partners in, at this stage, competing consortiums will be further strengthened by cross-fertilization of ideas and experiences between UDW projects (for instance ongoing NUFFIC projects and Regional Delta Planning Training Workshops supported by the Delta Alliance).

The results of research activities are to be reported in Working Reports, papers in proceedings, international scientific journals, and two PhD-dissertations. The project aims at at least two international journal papers or book contributions per PhD, and at least two on overall project results, reporting on the integrative activities and the linkages between action research and the negotiated approach. Results will further be communicated to the scientific community through larger scientific conferences to present research set-up, experiences and results.

7. Time table

The time table for project activities is provided below, distinguishing between activities with a research character, activities that combine research with development, and activities for capacity building and communication. Details about all activities is provided in the previous tables (Section 6). Before presenting this table, however, first some additional explanation about the linkages between activities and the overall project planning is provided.

Expecting a final decision early 2014, prior to formally starting the project, PhD researchers will be recruited in the first months of 2014. Following recruitment, all project positions are filled. In addition to the project activities as outlined in the table below, the PhD-candidates will follow the PhD trajectories within the graduate schools of their respective institutions (TU Delft and BUET). This entails course work, as well as the development of a full research proposal for their PhD theses in the first year and a defense of a PhD thesis after four years. For both the northern and southern PhD position, functional preference is given to candidates who are familiar with the conditions in Bangladesh and/or West Bengal, as the cases in both states will play a key role in the PhD researches. Furthermore, close interaction between (PhD) research and Negotiated Approach activities requires researchers that can work with local stakeholders.

A project inception workshop is planned in Kolkata early on in the project, aimed at coordination among project staff, but also to further develop good working relations with partners and stakeholders in Kolkata. This project inception workshop is to be followed by annual project meetings, alternating between countries.

Stakeholders will be involved from the start in project activities through pre-scoping interviews, followed by focus group discussions and key informant interviews for data collection. More visible workshops aimed at capacity building and development are started in year two. A more specific set-up for this stream of workshops is to be developed during the first project year, ensuring a good fit with ongoing activities that aim to engage and capacitate local stakeholders around water management and planning in the peri-urban areas. Once started, Negotiated Approach workshops are held twice a year for the remaining project duration. This is to keep

momentum in the development of Negotiated Approach processes among local stakeholders and between stakeholders and (state) government officials. At two points in the projects, stakeholder and government representatives from one country will be invited to join cross-case learning workshops in the other country. These workshops, once in India, once in Bangladesh, will help to reflect and get new ideas and perspectives for action. Negotiated Approach activities will conclude with exit workshops, where results and changes will be discussed, as well as an outline for further actions beyond the project time-frame.

The project comprises several meeting and workshops that require international and local travel. In order to make an efficient use of resources, these meetings and workshops will be planned in a coordinated way. Also, some workshops will be combined to meet different goals. Especially the cross-case learning and self-assessment workshops show potential for synergies in this regard.

Development and research activities are linked through integration activities, whereby research results are developed into materials, tools or structures that support Negotiated Approach workshops. These include joint fact-finding on groundwater status and possible scenarios, a multi-dimensional assessment to identify priority issues, serious gaming and joint sense-making. Internal cohesion is further ensured through the aforementioned project meetings, as well as through the involvement of a Project Advisory Group. This group will meet at least once a year to offer reflective inputs and practical advice for the project committee. Furthermore, they will be engaged in offering additional external linkages to policy and practice. These advisory group meetings will be partly in virtual space.

Table: Timing of project activities

ACTIVITIES	PROJECT YEAR / quarter															
	1				2				3				4			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
RESEARCH MAPPING ACTIVITIES	RESEARCH MAPPING ACTIVITIES															
1 Groundwater system mapping & impact assessment																
1.1 Pre-scoping assessment																
1.2 Data collection (incl design)																
1.3 Hydrogeological mapping (incl report)																
1.4 Scenario development																
1.5 Modelling for impact assessment																
1.6 PhD thesis writing																
2 Socio-economic system mapping																
2.1 Pre-scoping assessment																
2.2 Data collection (incl design)																
2.3 Socio-economic mapping (incl report)																
3 Institutional system mapping																
3.1 Pre-scoping assessment																
3.2 Data collection (incl design)																
3.3 Institutional analysis (incl report)																
4 Joint data collection																
4.1 Consolidate data collection designs																
4.2 Household survey, FGD, KII																
4.3 Formatting data for further analysis																
INTEGRATION & DEVELOPMENT	INTEGRATION & DEVELOPMENT															
5 Integration: Index-based (MGPAT)																
5.1 MGPAT analysis of survey data																
5.2 Translation MGPAT results into NA materials																
5.3 Evaluation MGPAT use NA workshops																
5.4 Write-up & paper(s)																
6 Integration: Game Theory																
6.1 Game theory models and analysis																
6.2 Translation of GT models into serious games																
6.3 Evaluation serious games for NA workshops																
6.4 PhD thesis (Instit & games) & paper(s)																
7 Integration: Grounded Theory																
7.1 Coding and developing key concepts																
7.2 NA workshop interactions & iterations																
7.3 Developing narrative accounts																
7.4 Write-up & paper(s)																
CAPACITY BUILDING & DEVELOPMENT	CAPACITY BUILDING & DEVELOPMENT															
8 Negotiated Approach (NA)																
8.1 Preparatory activities & pre-scoping																
8.2 NA workshops, local and local-state																
8.3 NA internat'l learning & reflection workshops																
COMMUNICATION	COMMUNICATION															
9 Communication and learning																
9.1 Project Workshops																
9.2 Set-up website and project ICT tools																
9.3 Cross-country learning workshops																
9.4 Self-Assessments & Reflection																
9.5 Progr Advisory Group Meetings																
9.6 Papers & meetings (science & policy)																

8. Consortium building and track record

a. Reporting on proposal development workshop

The development of the full proposal began with pre-consultation meetings in Kolkata (16th – 20th June, 2013) and Khulna (20th -24th June 2013) to ensure meaningful participation of stakeholders who had a high level of information, but who would have been unable to attend the following workshops.

The project team, including the senior members of the consortium, then gathered for a week in Bangladesh, for a proposal development workshop between 29th of June to 4th of July, 2013, which included stakeholder consultancy meetings in Dhaka and Khulna. Governmental and intergovernmental authorities, private organisations, universities, knowledge and research institutes, NGOs, community members, activist groups, and local media were involved with the purpose of i) enriching our knowledge on the issues the proposed project intends to tackle; ii) getting their feedback to improve our research framework; and iii) exploring collaboration opportunities to enable a meaningful and long-term impact of the project.

The meeting in Dhaka was a high level policy consultancy meeting where participants were mainly from relevant government departments and international research organizations. This one day meeting was split into two broad sessions. The morning session involved discussion on the crucial aspects of ground water development, management and policies. Invited speakers (senior officials from WARPO, BWDB, DPHE and DoE) shared their experience on ground water security, groundwater policies, urbanization processes, conflicts/cooperation etc. Then, the proposed research framework was presented to the workshop participants for their feedback. Presentations and discussions that followed provided a platform for thoughtful deliberation and open debate on groundwater issues in the peri-urban areas and about the overall setup of the research, and possible collaborations and partnerships. Post lunch was designed to involve participants into several group activities for developing problem tree, objective tree, and actor mapping with a purpose to further develop the impact pathway of our proposal. The active participation and open debate among the participants, among whom there were many government officials and policymakers, offer a good basis for further working relations on the issue of groundwater institutions in peri urban areas.

The Khulna workshop was a stakeholder consultation meeting where speakers and participants were from diverse backgrounds like government departments, researchers, academicians and environmental activists. It was a half day meeting designed to provide adequate scope for the local government and community members to express their views on groundwater security, sharing, conflict, contestations, policies etc. The central issue under scrutiny was the problem definition and analysis, triggering active participation by participants. A strong interest was expressed in the research project and the Negotiated Approach activities, leading to letters of support (see Annex).

The Khulna workshop was followed by a field visit to Phultala village, one of the peri-urban sites facing severe conflict with the city administration in sharing the ground water. Meeting with women groups provided thoughtful insights to local dynamics of ground water (in)security shaped by physical, social and institutional factors. Lively discussions with community representatives opened up for collaboration opportunities with local users and local administration.

b. Consortium: roles and added value

Delft University of Technology leads the consortium based on cutting-edge expertise in the area of actor modeling and systems analysis, serious games, and experience in the support of water policy in the Netherlands as well as developing countries. The consortium leader from TU Delft has ample experience with the management and execution of interdisciplinary research projects

(e.g. Multi-functional flood defenses, Building with nature, Energy transitions, Knowledge for climate). The backbone for the activities in India and Bangladesh is formed by a successful southern partnership between SaciWATERs and BUET/IWFM that dates back to 2006, when they formed a consortium to implement a South Asia regional capacity building programme on gender and water. This established a strong partnership between southern institutions in interdisciplinary water education and research, which won research awards from IDRC and NWO-CoCooN. For the latter, they are also cooperating with JJS, the civil society partner in Bangladesh.

The proposed project will continue this partnership to directly link physical, social and institutional systems with groundwater poverty and security in the peri-urban communities in the Ganges delta. The three civil society organizations (CSOs) in the consortium support the effective linkage between research and development, as they are directly working with affected communities. Both ENDS is an independent NGO that works towards a sustainable future for our planet by identifying and strengthening CSOs (among them JJS), on issues of water management, gender, socio-economic development and the rights based approach. Both ENDS has been working on the Negotiated Approach, based on positive experiences with bottom-up local initiatives, translated into government policies, in various countries. Jagrata Juba Sanstha (JJS) is a non-profit NGO working on environmental and social justice from 1998 in the South-West region of Bangladesh. The Researcher is a Kolkata-based independent organization, currently engaged in projects with IWMI on water management in West Bengal. Both ENDS and TU Delft have in the past jointly investigated the theoretical foundations of the Negotiated Approach.

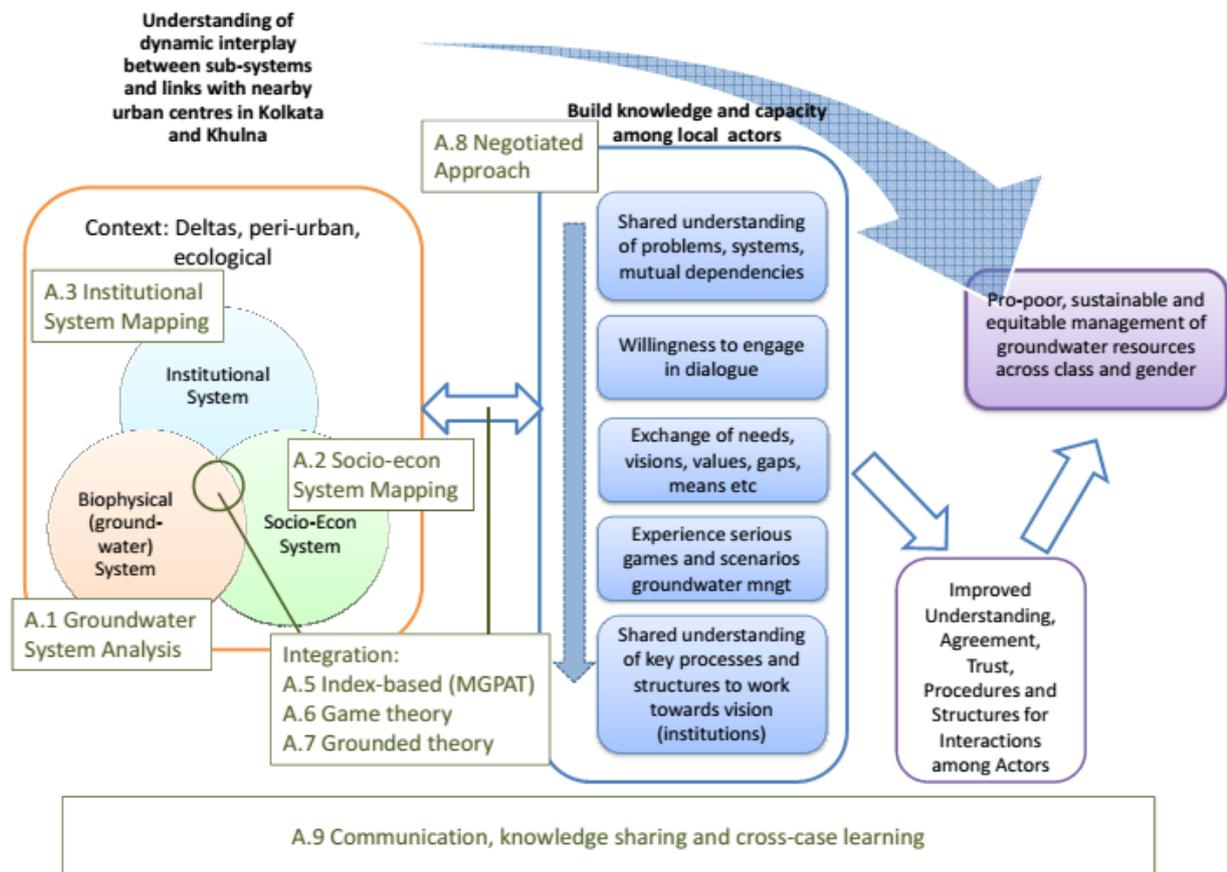
The proposed project takes forward the existing collaborations between consortium partners and links the existing south-south partnership with northern scientific and non-scientific institutions. The southern research partners (SaciWATERs and BUET) have a long history of collaboration and their role is to implement the project in each of the countries they are in. While SaciWATERs will coordinate the overall research and implementation program of this project in the sites of Kolkata and Khulna, BUET will contribute its key expertise in groundwater modeling to analyze the groundwater systems in both sites.

TU Delft, as the consortium leader, will bring the academic rigor for integrative scientific research and experience with overall project and financial management of interdisciplinary projects. Both ENDS will help link academic research activities with capacity building, using its experience with the negotiated approach as a basis. It will also offer innovative ways, such as serious games, through which the capacities of government and non-government officials in two countries are built. For this, Both ENDS will work with the southern partners JJS and The Researcher.

c. Theory of Change

The overall objective of the project is to build knowledge and capacity among local actors to support a transformation process in peri-urban delta communities in Bangladesh and India for a pro-poor, sustainable and equitable management of groundwater resources across caste/class and gender. This will be based on an improved understanding of the dynamic interplay between local livelihoods, the groundwater resource base, existing institutional systems and links with nearby urban centres in Kolkata and Khulna.

Analytical mapping and integration activities are fed by, and provide support for, stakeholder processes through their direct linkage to workshops and trainings undertaken for the negotiated approach process. In addition to the capacity building and communication embedded in these activities, some additional activities in this field are foreseen through linking up to external processes and actors.



9. References

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Annex 5 Letters of Support (optional)

Embassies of the Kingdom of the Netherlands (required):

1. Embassy in India
2. Embassy in Bangladesh

PLEASE NOTE: BECAUSE OF FILE SIZE LIMITATIONS, WE HAVE INCLUDED THE (OPTIONAL) LETTERS OF SUPPORT LISTED BELOW IN A SEPARATE FILE

Civil Society Organizations not represented in the Consortium:

3. Bangladesh WASH Alliance, Dhaka, Bangladesh *
4. WaterAid in Bangladesh, Dhaka, Bangladesh

Government agencies:

5. Barrackpore-II Block Development Officer, Government of West Bengal, Kolkata, India
6. Batiaghata Upazilla, Khulna, Bangladesh
7. Department of Public Health Engineering, Ground Water Circle, Dhaka, Bangladesh *
8. Fultala Upazilla, Khulna, Bangladesh
9. Khulna Water Supply and Sewerage Authority KWASA, Khulna, Bangladesh *
10. Public Health Engineering Department, Khulna Division, Khulna, Bangladesh *
11. Water body Management Board, Kolkata Municipal Corporation, Kolkata, India
12. Water Resources Planning Organization, Bangladesh
13. West Bengal Wasteland Development Corporation, Kolkata, India

Private sector companies:

14. Bagerhat Seafood, Khulna, Bangladesh
15. Blue Gold / MottMacdonald, Dhaka, Bangladesh
16. Gazi Fish Khulna, Bangladesh
17. PAN Network Pvt Ltd, Kolkata, India

Research, academic institutes and (international) knowledge platforms not represented in the Consortium:

18. Bidhan Chandra Krishi Viswavidyalaya, Faculty of Agriculture, Kolkatta, India
19. Cap-Net UNDP International Network for Capacity Building in Integrated Water Resources Management, Pretoria, South Africa
20. Center for Environmental and Geographic Information Services (CEGIS), Dhaka, Bangladesh
21. Centre for Studies in Social Sciences, Calcutta, Kolkata, India
22. Department of Business Management, Calcutta University, Kolkata, India
23. Human Development and Research Institute, Kolkata, India *
24. Indian Institute of Technology Guwahati, Department of Humanities & Social Sciences, Guwahati, India
25. Khulna University - Urban and Rural Planning Discipline *
26. Khulna University - Environmental Science Discipline *
27. Khulna University of Engineering & Technology, Department of Civil Engineering *

* Pre-proposal Letters of Support

Annex 6: Two-page description of the proposal development workshops

Overall objective and activities

To establish links with multiple actors and research collaborators to enrich knowledge, improve the relevance and quality of the proposed research programme, and to explore collaboration opportunities for developing the larger consortium. The purpose of the proposal development activities was to ensure involvement of diverse actors for a meaningful and long-term impact of the project. Exploratory studies through key informant interviews and focus group discussions (FGDs) were conducted in villages of peri-urban Khulna and Kolkata for deliberations of field insights in the workshops and its subsequent integration into the full proposal. Pre-consultation meetings were conducted with relevant government department personnel in Kolkata to ensure meaningful participation of stakeholders who had a high level of information, but who would have been unable to attend the following workshops. FGDs were conducted in the villages of Shantinagar and mashialli of Batiaghata and Phultola blocks of Khulna Metropolitan Area and in the Khea ghata, Ganga Jora, Khuri Gochi and Gor khara villages of Sonarpur block in South 24 Pargana district of Kolkata Metropolitan Area.



Government pre-consultation meetings, Kolkata

Date: 19-20th June 2013 | Location: various Government office premise

Pre consultation meetings were conducted with the officials of Sudarban Block Development, Chief scientist of Groundwater Investigation Board, Kolkata, Secretaries of Irrigation and Public Health Engineering Department, Government of West Bengal, India. Discussions revolved around key issues of groundwater availability, quality, monitoring and policies. Discussion provided insights into the large scale apathy of the state to monitor groundwater systematically particularly in the southern coastal belt. The impacts of recent regulatory changes such as the 2011 Groundwater Act remain uncertain. Deliberations were made to find out ways for involving these departments as a part of larger consortium.

Dhaka Workshop, Bangladesh

Date: 29th June 2013 | Location: Rigs Inn Hotel



The first policy consultancy meeting was organised by IWFM, BUET with the participation of 30 representatives from various relevant government departments of Bangladesh. The workshop was divided into two broad thematic sessions. The morning sessions consisted of a brief presentation of the proposal along with the results of the pre-consultation meetings and interviews in peri-urban Khulna and Kolkata by Prof Wil Thissen, TU Delft, followed by a panel discussion of the government officials. Representatives from the Water Resources Planning Organization (WARPO), Bangladesh

Water Development Board (BWDB), Department of Public Health Engineering (DPHE) and Department of Environment (DoE) talked about the critical issues associated with groundwater management in the peri-urban deltaic tract of Khulna and their involvement in addressing some of these emerging concerns. Post lunch was mainly focussed on critical feedback on the proposal and group activity wherein problem exploratory and impact pathways were deliberated and discussed. Participants took active part in discussing and exchanging views on problem tree, objective tree, actor mapping and mapping of power interest grid. The workshop was closed by fruitful, critical, and constructive discussions on the overall setup of the research, concepts used, the logical framework, and possible collaborations and partnerships.



Results (some of the core comments):

The challenge of comparative understanding between two different countries

The criticality of undertaking comparative assessment of groundwater resources in moribund deltaic tract of two neighbouring countries has been strongly brought out by the participants. Relevancy of such kind of studies particularly between India and Bangladesh has been highly appreciated; however suggestions were made to have clear understanding of the policy implications of such kind of assessment. The discussion revolved around integrating physical and institutional components with emphasis on policy analysis (gaps) in both the countries.

Capturing the rural-urban continuum (peri-urban) be for uptake in the policy domain

Setting up criteria for defining peri-urban in the study design was strongly recommended by the government participants. So far, the peri-urban area is not recognized in formal legislation and procedures, which hinders attention for its specific needs. The discussion concluded that setting up such criteria will be helpful to identify and recognize them in the official/policy domain, but that the dynamic nature of the peri-urban areas would limit the effectiveness of any effort solely aimed at capturing it in static administrative definitions.

Integration of fluvial and deltaic processes into the research design

Fluvial and deltaic processes are strongly interlinked, shaping and reshaping the deltaic ecosystem. Highlighting this point suggestion came to integrate fluvial process and the developmental initiatives (in form of dams, embankments), affecting the deltaic processes, into the research objectives. It has been recommended to also look into the inter-linkages of changing deltaic processes with ecosystem degradation.

What the proposed project addressing to: institutional, technological or both?

Integrating physical, technological and institutional aspects with clear mentioning of conjunctive use of surface and groundwater have been recommended. Some issue-based thematic mapping like arsenic mapping of the groundwater etc should be addressed.

Khulna workshop, Bangladesh

Date: 30th June | **Location:** CSS AVA Centre, Khulna, Bangladesh

The Khulna workshop was conveyed by JJS in association with IWFM, BUET. It was a half day stakeholder consultation meeting essentially with the service providers, environmental activist, local administrators and community representatives. The meeting was followed by a field visit to the village of Phultola, a peri-urban site currently facing severe problems in sharing groundwater resources with the Khulna City Corporation (KCC). Discussions with the women group provided thoughtful insights into the localized freshwater sources, conflicts with different user groups, and the environmental movement that has taken place against the municipality in extraction and transfer of the groundwater, which they consider as theirs.



Results (some of the core comments):

Long-term recommendations and involvement of community
Participants appreciated the topic of 'groundwater assessment in peri-urban Khulna' and suggested some interesting cases to study in Phultola and Bhatiaghata blocks. The issue that was raised many a times during the discussion was involvement of community in knowledge sharing and negotiation processes. Participants stressed the fact that it is crucial for the local administration as well as the common villagers to know about their groundwater scenario, and they urged for long-term recommendations from the data to be generated from the project.

Measuring conflict, its types and levels

Using simulation modelling for mapping and quantifying conflicts and contestations were recommended. It was further suggested that conflict mapping should be correlated with mapping of the water chemistry and water demand to have a holistic picture.

Embedding policy analysis into the research framework

A detailed analysis of existing policies and regulations was highly recommended. Suggestions for more effective integration of research outcomes into the groundwater and environmental policies at different level of regulation and implementation.

Focus on pollution particularly dumping of solid waste

The project although talks about arsenic and salinity related pollution issues it however fails to explicitly mention about solid waste dumping on the surface and in turn degrading the groundwater source. An explicit mentioning of the same was suggested.

Annex 7: Project Advisory Group Description

The consortium will form a Project Advisory Group (PAG) consisting of four to five members. The PAG will be chaired by one of their members. The PAG will support the Project Committee by reviewing performance of the program. The PAG will review program against the results chain and Theory of Change and will support strategic issues around policy and advocacy, government linkages and opportunities for external collaboration. The PAG will meet at least once a year, but if necessary will organize special meetings as per the program strategic needs. PAG meetings will be organized in relation to annual project consortium meetings, and may take the form of electronic meetings to economize on project resources.

The mandate of the PAG will be developed later highlighting the following key issues:

- Advice; to advise on the annual plans and progress reports.
- Network; to advise on the scientific quality and on opportunities for other donor funding and additional private sector funding for the programme.
- To engage relevant and strategic actors and institutions, and inspire and support the program as a whole and the local roundtables.
- Guide: Provide guidance on policy development, monitoring, control and evaluation.

Suitable candidates have been consulted and have indicated their willingness to support the project as part of the Project Advisory Group, as indicated below.

Proposed Members (in no particular order):

Dr. Mustafa Alam

Professor Department of Economics, University of Dhaka

Email: mstfalam@gmail.com

Dr. Alam knows the Negotiated Approach methodology and the water management situation in the Khulna region quite well. He was involved in the evaluation of the KJDRP program, an ADB financed water management project in the South-West of the late nineties.

Dr. Anamika Barua

Indian Institute of Technology Guwahati

Department of Humanities & Social Sciences

Guwahati - 781 039 (Assam), India

E-mail: abarua@iitg.ernet.in

Dr. Barua has worked on water applications of the Multi-dimensional Poverty Assessment Tool. She has extensive experience with the use of integrative systems analysis methods in water management.

Dr. Sultan Ahmed

Director (Natural Resources Management)

Department of Environment

Government of the People's Republic of Bangladesh

Email: sultan.doe@doe-bd.org

Mr. Saiful Alam

Principal Scientific Officer, Water Resources Section

Water Resources Planning Organization (WARPO)

Ministry of Water Resources

Government of the People's Republic of Bangladesh

Email: psowr@warpo.gov.bd

Dr. Kalyan Rudra

Chairman, West Bengal Wasteland Development Corporation

Kolkata-700055, West Bengal, India

Email: rudra.kalyan@gmail.com

Dr. Rudra had been working on changing river courses of the western Ganga-Brahmaputra delta during the last three decades. His experiences will help to see the fluvial system, and the developmental initiatives (dams, embankments etc) in order to understand better the groundwater scenario holistically.

Mr. Jayanta Basu

Environment Correspondent; The Telegraph, India

Faculty, Dept. of Environmental Sciences, Calcutta University

Member of Water body Management Board, Kolkata Municipal Corporation

Member, Ganga Mekong International Dialogue

Director, Environment Governed Integrated Organisation

Email: jayantabasu.cal@gmail.com

Mr. Basu has long been associated with the trans-boundary (India and Bangladesh) initiative to counter environmental and related social issues and also part of the governing body of 'Sunderban Trans-boundary Platform' created sometimes back as a civil society initiative.

Dr. Priya Sangameswaran
Assistant Professor Development Studies
Centre for Studies in Social Sciences, Calcutta
Email : priya@cssscal.org

Dr. Priya Sangameswaran works broadly at the intersection of developmental studies and environmental studies. She has been researching water sector reforms, and more specifically, how these changes link to larger debates about neoliberal development, rights, equity and commodification of resources. She holds a Ph.D. from the University of Massachusetts, Amherst.