URAdapt

Managing Water at the Urban-Rural Interface: The key to climate change resilient cities

FINAL TECHNICAL REPORT

FINAL TECHNICAL REPORT - OVERVIEW

Project Name:	Managing Water at the Urban-Rural Interface: The key to climate change resilient cities (URAdapt)
IDRC Grant Number:	105869-001
Research Institution:	International Water Management Institute (IWMI) Country partners: CSIR Water Research Institute, Ghana and Addis Abeba University, Ethiopia
Project Location:	Accra, Ghana and Addis Ababa, Ethiopia
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EXECUTIVE SUMMARY

The water resources sector will be among those most affected by changes in climatic conditions. Due to the interconnectivity between upstream and downstream areas, alterations in water quality and quantity in one will have implications for resource availability in the other. Access to basic water supplies is already constrained in much of sub-Saharan Africa, and the situation is expected to be exacerbated by future changes in the climate. Strategies to build climate change resilience in urban water sectors in Africa must adopt a broad perspective; one that recognises the dependence of urban centres on outlying rural areas, particularly where these supply water and food for cities. Simultaneously, resilience strategies must account for the relationships between multiple water-use sectors.

Whilst research on mitigation has advanced more rapidly, research on climate change adaptation strategies has been much slower to take off. Such research has focused mostly on water resources management for rural agriculture. Simultaneously, urban infrastructure planning has so far ignored climate change and its related consequences for urban per capita water needs (supply side and demand side) and wastewater disposal. Unlike in ´matured´ cities in the developed world, where impacts are mostly limited to those from climate change (since other planning and development processes are more streamlined), cities in developing countries of the world are confronted with the dual problem of dealing with impacts of climate change and anthropogenic effects of expansion of built environment. Additionally and most importantly, these cities are less prepared technically, institutionally, and policy wise to address climate change. It is anticipated that under such circumstances the future challenges remain enormous.

The URAdapt project filled these gaps by examining the impacts of climatic and demographic changes on urban water resources management in Accra, Ghana and Addis Ababa, Ethiopia. These sites exemplify problems typical to developing cities in sub-Saharan Africa. The project built upon 3 specific research objectives namely:

1. Develop a shared understanding amongst multiple stakeholders of climate change and its effects on water management at the urban-rural interface.
2. To generate new knowledge using scenarios, on the upstream and downstream implications of urban water demand, and of resulting wastewater generation, as well as on water investment needs.
3. Prepare, in participation with city stakeholders and for the benefit of the most vulnerable groups, a strategic action plan for adapting to climate change based on improved water resource management.

In achieving these objectives and moving towards policy development, URAdapt recognized that contextually relevant and sustainable solutions can only arise out of mutual learning and collective action. It therefore facilitated a science-policy dialogue, which applied a Participatory Action Research (PAR) approach, which involved setting up a stakeholder platform - the Research into Strategic Action Platform (Re-SAP) – to reflect the multiple perspectives of urban water management. In order to address uncertainty and adaptation the project maintained an “organic” character, which allowed for flexibility both in terms of structure, composition and functioning of the platform, and also in terms of the research studies.

URAdapt devised an integrated analytical framework which comprised climate downscaling to city level, hydrological modelling to project water availability and allocation under different climate and basin water use scenarios, and water balance studies to understand the water supply-demand gap and the water-wastewater interactions. Flood risk was analysed through runoff modelling and vulnerability of populations was quantified in terms of exposure to flooding, service levels for water

and sanitation and associated health risks. The urban-rural interactions were incorporated through downstream water quality impacts and related vulnerability, and water management considerations in a water basin/shared resource context. The knowledge generated was consolidated into strategic recommendations for adaptation at the city level for the two cities.

In Accra, the impact of climate change on water availability, showed that reduced flows in the already stressed Densu water basin serving the water needs of the city, would in turn set agriculture as a competitor for the water resource in a basin. Future water requirements would have to be sourced from the Lower Volta whose flows would be much less affected by climate change. In direct contrast, in Addis Ababa, projected increase in flows was expected to translate into a significant increase in storage reservoirs feeding Addis.

The impact of expansion of built area (non-climate driver) on urban hydrology in an urban catchment of Addis Ababa, was more substantial than that of increased rainfall alone. In Accra risk maps indicated that new urban areas are subject to flooding mainly due to poor and under-designed drainage.

In Addis Ababa, change in return periods for peak floods has implications for the design criteria and standards used for urban storm drainage networks.

A distinct supply demand gap in the water supply sector was observed for the two cities, with supplies not being able to meet even current demands. Individual buffer storage which in Accra represents a substantial volume of storage at a given time, is the response by urban householders to counter this inadequacy. Planned expansion was inadequate to meet the demands. Sourcing water to fill this gap from more distant sources is becoming a reality in both cities compounded by the geographic and hydrological positioning of the city within the basin (Accra's storage reservoir is at the downstream end of a watershed, whereas Addis Ababa's reservoirs are at the head end of the basin). In Addis it was shown that up to 34% savings can be made through water conservation measures and the use of water saving technologies.

Wastewater generation in both cities will increase as expected with the increased water use linked to improved well-being, but the downstream impacts on farmers and livestock are much more immediate in Addis Ababa than in coastal Accra where wastewater drains to the sea. Changing weather patterns in Addis Ababa are causing unanticipated seasonal increases in pollution loads in the river leading to livestock death and livelihood losses. In Accra the rural-urban interactions are manifested through the expected increased use of water for agriculture under drying scenarios in a basin (Densu) that is already water stressed. In Addis Ababa these interactions are more targeted to the Finfinne zone (and not to a basin), which has a symbiotic relationship with the city. Changes in water use in the Finfinne zone will have implications for common water resources. Under climate change urban-rural interactions will be exacerbated, but these concerns are seldom addressed due to institutional weaknesses.

In Accra flood vulnerable communities and notably children living there, face higher health risks, resulting from inadequate water and sanitation services. At risk communities were seen to be capable of articulating their adaptation needs but local governance and planning processes were not geared for their participation in decisions. Prioritising spatial planning and implementation of existing zoning and land use plans was identified as a critical lapse in flood management. Differential vulnerability between communities in Addis Ababa was linked to poverty, quality of housing and water and sanitation service provision.

In Addis, it was seen that national institutions and processes and those at city level provide a supporting environment for responding to climate change adaptation with a strong willingness showed by citizens to participate in adaptation. However there was low implementation capacity

across levels of government and sectors. Other weaknesses identified were that policies were lacking for encouraging water-efficient technologies and supporting full cost recovery in water service delivery, which would be effective in curbing wastage especially of large domestic users. There was neither a wastewater management policy, nor an effective agricultural policy that supports urban agriculture where treated wastewater could be recycled, as a substitute for fresh water.

In Accra both the climate change policy and the decentralisation policy which should be implemented concurrently, were in a state of flux. The lack of a single point of coordination with dedicated capacity was seen as a limitation in moving the climate agenda forward. Sector policies and strategies do not yet address climate change and adaptation effectively. Water allocation and management decisions would be enhanced with public/community participation but institutions were not sufficiently flexible to respond to this need. Basin water management was still incompletely decentralised, therefore basin authorities lacked resources. The overlap between flood management and flood response interferes with clear definition of mandates and responsibilities at national and local level.

These key research findings and recommendations were consolidated into 3 strategic objectives respectively for the two cities.

For Accra these were:

1. Enhancing the adaptive capacity of the city and its communities to flood impact and climate change.
1. Adopting integrated climate-resilient water supply and demand management in the Densu Basin.
2. Strengthening institutional capacities to address water related climate change impacts.

For Addis Ababa these centred around:

3. Adopting regional integrated water supply and demand management.
4. Integrated flood risk management.
5. Developing best practices for wastewater management.

The main output was a city strategic agenda for adaptation for each of the project cities. This provided key strategic directions to policy makers and practitioners on how to make the urban water system in the respective cities more resilient to climate change. The intended users of the outputs were the respective city and national level authorities who have a stake in urban water management. In Addis Ababa the main users/implementers for the recommendations were seen to be the Addis Ababa municipality and the Research Directorate of the Ministry of Water and Energy. The Addis Ababa city manager a key player in city water management, was involved from the inception of the project in order to expedite uptake of recommendations. The other major players coming under his jurisdiction were the Addis Ababa Water and Sewerage Authority, other relevant technical departments and the Environmental Protection Agency, all of whom participated directly in the development of the strategic agenda and the recommendations, and were moreover targeted for uptake and dissemination through one on one meetings. Regional players like the Oromiya water bureau were specifically targeted for dissemination, and were also provided opportunities to participate.

In Accra, whilst the technical departments and members of the Accra Metropolitan Assembly participated actively in the development of the agenda and were also targeted for uptake and

dissemination, it was realized that they did not have decisions powers over the management of water resources. Here the main decision makers were the national level authorities such as the water utility, the Ghana Water Company which was individually targeted as were the Water Resources Commission of the Ministry of Water Resources Works and Housing, the Ministry of Environment Science and Technology and the Environmental Protection Agency. In Accra a final policy briefing was also held to disseminate the findings and the strategic agenda. What was innovative about this output was the process involved where PAR was facilitated with policy actors.

A "process study" was commissioned as an additional activity of the project. This allowed for a deeper understanding of the project process, its evolution, and the qualitative project outcomes. Some of the foremost outputs and outcomes were:

1. Research reports and thesis which were the foundation for 9 journal papers (under finalization for publication).
2. The creation of the science-policy dialogue platforms in each of the cities over the lifetime of the project to translate research to strategic action (the ReSAP). These were not intended to survive the project but they appear to have strengthened cross fertilisation amongst stakeholders, resulting in new partnerships for research, and a resource base of informed stakeholders who could move the climate debate forward.
3. A Research uptake and exit strategy prepared for Addis Ababa at the request of the Ministry for Water and Energy.
4. *Establishment of a cohesive team* of researchers across the two project locations:- the cohesion between team members contributed enormously to the success of the project.
5. *Improved learning/understanding about policy processes* and how these should be used for the benefit of the project:- the importance of process cannot be underestimated, and the level of policy influence is a function of the level of understanding of related policy and decision processes.

A clearer understanding of stakeholder engagement processes, and how these can be strengthened was also elucidated by the study.

Strategic lessons emerging from the project were as follows:

Shaping the policy agenda: We learnt that the presence of direct policy actors, on the science-policy platform, helped shape the strategic agendas for the two cities. A hierarchical targeting for policy influence was also necessary, targeting the different levels of policy actors. The importance of process was recognised where policy was seen as a dynamic, non-linear process. There was clear indication that understanding policy influencing processes was the first step in translating research to policy, and that a clear step by step process outlining actions needed, would be required.

Working through partnerships: stakeholder input is critical to the research process, from *designing the analytical research activities, to formulating subsequent evidence-based adaptation strategies, to monitoring progress.* The active participation of local researchers who are the levers of change, has to be explicitly built into research design.

Disciplinary orientation: No project is static and this is specially reflected in projects around climate adaptation where both uncertainty and lack of data has to be accommodated. The research team serves as a driving force and team composition shapes project evolution. Interdisciplinary exchange was found to be very enriching as was the inclusion of indigenous information from vulnerable communities and information and expertise from non-research stakeholders such as policy and decision makers.

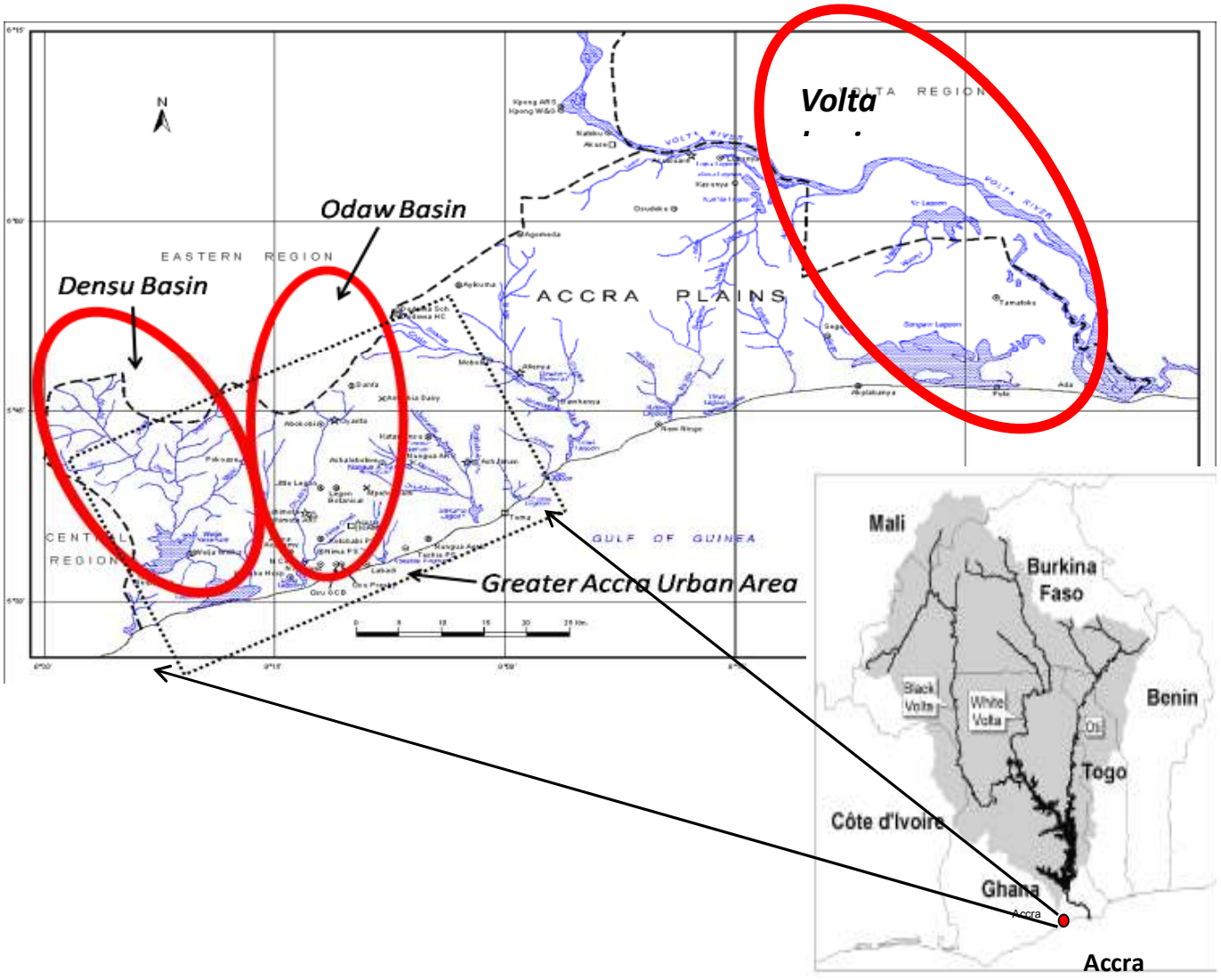
Incorporating a process study into project design: The process study that was undertaken by the project during its lifetime, was an unexpected achievement, as it allowed for a deeper understanding of the research and uptake processes from the perspective of both the research teams and the involved stakeholders. In particular the historical narrative of project evolution, identified in qualitative terms, the emerging contributions URAdapt has made towards climate change preparedness, and the features in its operational design and strategy that allowed URAdapt to make such contributions. Though the study was not part of the original design, it is recommended that this be made standard practice of projects.

Limits of project based research: Both donors and international research bodies must recognise the limits of project based research for achieving development outcomes and more particularly so in the area of climate adaptation. Both should sustain more programmatic approaches and potentially rethink their position about sustaining long term relationships.

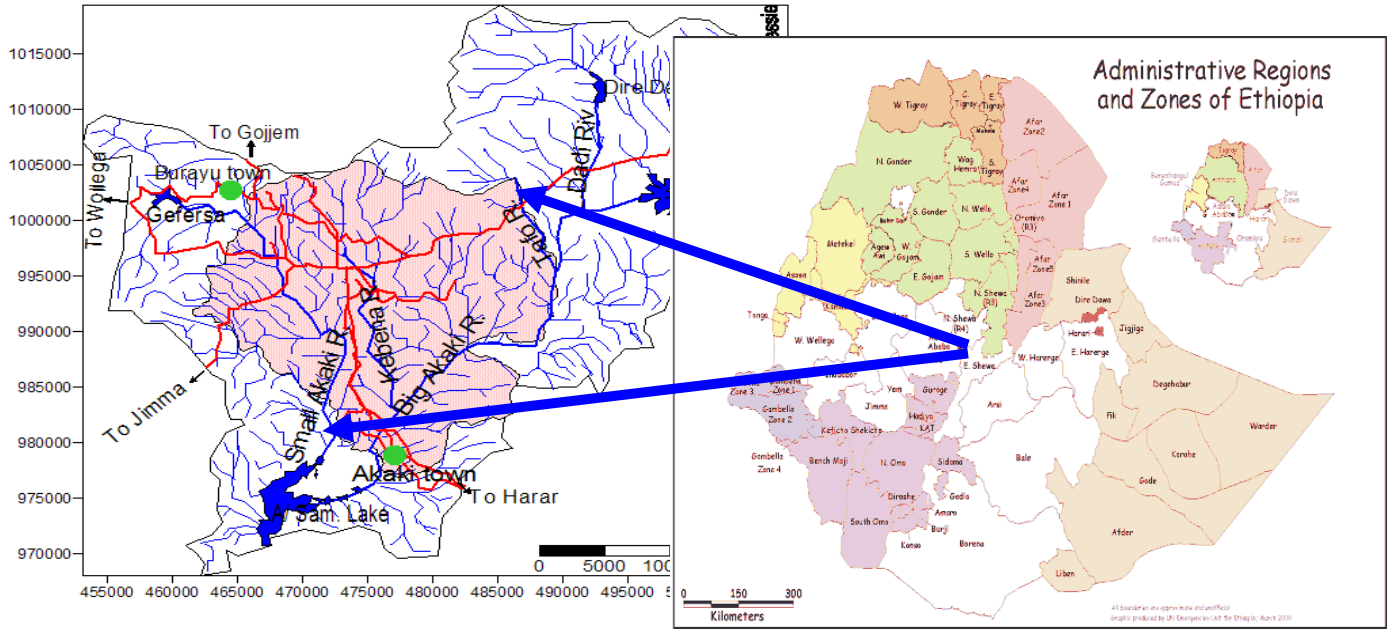
Leveraging resources for urban water sector development: Finally it was clear that in environments (as in developing African cities) where urban planning processes and institutions are weak and resources limited, populations in cities are vulnerable to inadequacies in water supply, disposal of wastes, and flooding, even in the absence of climate change impacts. Climate change is an additional factor to be contended with. Therefore by leveraging resources, adaptation projects can also improve the general conditions of cities, which is a factor that can be exploited to improve urban planning.

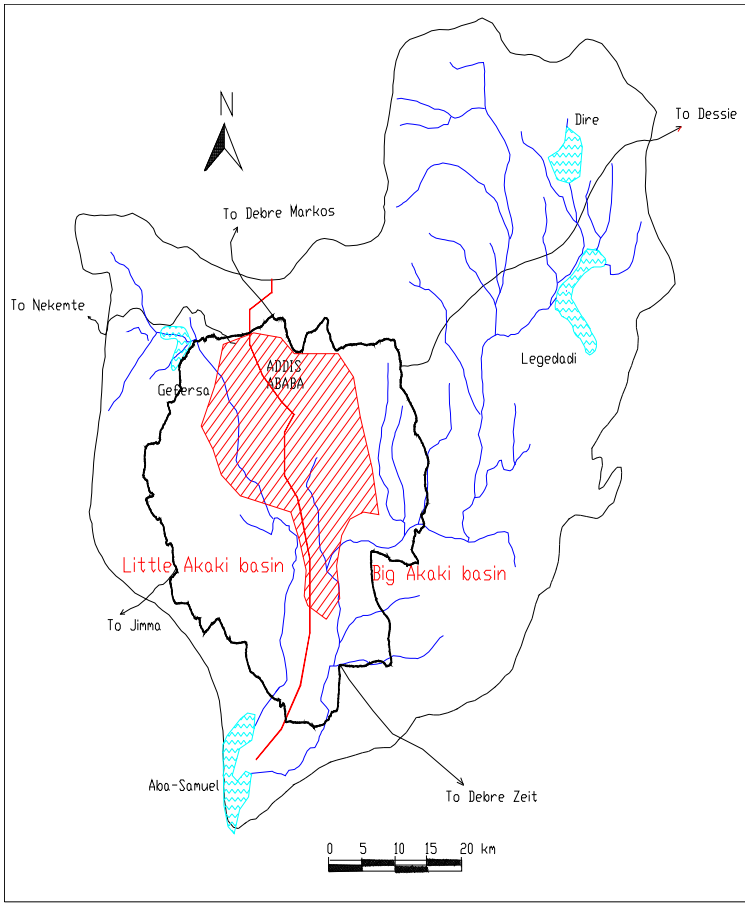
LOCATION OF PILOT CITIES

Accra, Ghana



Addis Ababa, Ethiopia





CHAPTER 1 – PROJECT RATIONALE AND RESEARCH PROBLEM

Rationale and Research problem:

The water resources sector will be among those most affected by changes in climatic conditions. Due to the interconnectivity between upstream and downstream areas, alterations in water quality and quantity in one will have implications for resource availability in the other. Access to basic water supplies is already constrained in much of sub-Saharan Africa, and the situation is expected to be exacerbated by future changes in the climate. Strategies to build climate change resilience in urban water sectors in Africa must adopt a broad perspective; one that recognises the dependence of urban centres on outlying rural areas, particularly where these supply water and food for cities. Simultaneously, resilience strategies must account for the relationships between multiple water-use sectors.

Whilst research on climate change *mitigation* had progressed much further, research on climate change *adaptation* strategies was much slower to take off. When it had, it focused mostly on water resources management for rural agriculture. Simultaneously, urban infrastructure planning had so far ignored climate change and its related consequences for urban per capita water needs (supply side and demand side) and wastewater disposal. The URAdapt project filled these gaps by examining the impacts of climatic and demographic changes on urban water resources management in Accra, Ghana and Addis Ababa, Ethiopia. These sites exemplify problems typical to developing cities in sub-Saharan Africa.

The original project rationale and research problem remained valid. It was increasingly clear in climate adaptation and mitigation literature that whilst the urban flooding problem is more commonly referred to and addressed globally, other impacts on the urban water cycle and the upstream downstream linkages are mostly overlooked. For instance the issues around water supply (availability and use) and wastewater management tended to be addressed in urban areas, in response to the current development context and at best in the light of climate variability, but not necessarily to respond to climate change. Whilst URAdapt was only applied in two cities in Africa, we also developed a methodology of interaction at city level (described in the city strategic agendas developed. This and other knowledge gained from this exercise provides a deeper understanding about vulnerability and resilience of cities to urban water mediated impacts of climate change and how to frame policy recommendations and engage with policy formulators.

The importance, when making future water supply decisions, of looking at urban water supply in the basin context and accounting for surrounding water uses (present and future) which also highlights and integrates the urban-rural dimension, has been established as critical particularly in water stressed basins. Similarly the implications for city flooding, from surface flows occurring outside city boundaries, and poor storm water drainage design, have clearly emerged. It is also confirmed that the planning and governance arrangements in many countries do not account for climate change impacts on urban water systems. Water supply decisions are made in isolation taking account only of future urban expansion and economic growth. Thus by applying a more holistic and integrated approach and looking beyond the city boundaries, the URAdapt project set out to contribute to new knowledge as was the intention when the project rationale was developed.

Evolution of project concept:

In general, the main elements of the concept – empirical research that is shared with a stakeholder platform, which would provide feedback both in terms of problem definition and solution, leading to recommendations on city adaptation strategies – remained unchanged. However our understanding of the types of research that needed to be undertaken in response to the local needs and context, the institutional environment and technical and planning processes which influence the type of stakeholders needed on the platform; evolved in the first year of the project. The

conviction that the highest levels of policy and decision makers are essential to the process of uptake of recommendations, particularly those pertaining to national strategy, whilst at the same time, the main working platform should comprise technical and socio-economic experts from key national- and local-level organisations was also clearly enunciated. Essentially it was understood that the institutional platform should provide critical and analytical thinking to the process of knowledge generation. The strong evidence base established via the project would draw policy makers more strongly to translate this into policy instruments.

Stakeholder groupings to be represented on the platform were also crystallised (refer to Interim Report 1 in list of project outputs), and the role of marginal groups was recognised, with varied level of representation and interaction in the two cities. It was recognised however that vulnerability related studies at grassroots levels in the two cities would support the process of integration.

As a mechanism of response to the context of uncertainty and adaptation, it was recognised that the project should strengthen its "organic" character, which allowed for flexibility both in terms of structure, composition and functioning of the platform, and also in terms of the research studies. In the original concept the platform (research-policy platform) was an amorphous structure comprising also "policy making" without being explicit on 'whom' and 'how'. As the project progressed, this platform evolved into a strategic working platform and was re-named "research to (strategic) action platform" (Re-SAP). In parallel, in one of the cities at least, the need was recognised, for a "consultative group" of some key stakeholders identified from amongst the platform members, which would advise the project team on the big picture issues pertaining to climate change, urban development and water resources management.

Interaction for policy influencing and uptake was made explicit in our understanding, through targeted networking and meetings with key policy (and uptake) communities, such as the local authorities (municipalities) in the two cities, the respective utilities and key agencies dealing with water supply and wastewater management, water resources and climate change, in addition to participating in national level consultations on climate adaptation.

In the original project concept, though networking and knowledge sharing were mentioned, the importance of these elements was not sufficiently emphasised. It was later understood that when a project is not anchored in a government institution or is not part of bilateral funding or development assistance, it is important to have visibility, which can be achieved only through extensive networking. This aspect was also subsequently addressed.

Though it was not explicitly stated at the outset, the project identity evolved towards 'facilitating PAR (Participatory Action Research) with policy actors. By 'doing PAR with policy actors', URAdapt marked a slight departure from the mobilisation of PAR principles for adaptation in the agricultural sector, that IDRC had so far addressed; where PAR was typically employed on farmers' plots, which offered sites for collective experimentation. In urban areas, and in the case of URAdapt, the 'plot' consisted of the hardware of urban water infrastructure and the institutional arrangement that support it.

A final idea that evolved was that in environments (as in developing African cities) where urban planning processes and institutions are weak and resources limited, populations in cities are vulnerable to inadequacies in water supply, disposal of wastes, and flooding, even in the absence of climate change impacts, with climate change exacerbating an already vulnerable situation. The project was seen as a means to leverage resources also to improve the general conditions of the cities under study.

For a more detailed understanding of project evolution and history, please see the project output on the "URAdapt process study".

CHAPTER 2 - PROJECT OBJECTIVES

The project was expected to provide decision support for authorities to manage the urban water cycle in the face of climate change and urbanization. The project enrolled representative stakeholder groups including city authorities and representatives of vulnerable communities in the respective cities into a science-based interactive dialogue. This was to allow stakeholders to discuss the consequences of, and develop response strategies at various levels to, the changing circumstances.

The specific objectives of the project were to:

1. Develop a shared understanding amongst multiple stakeholders of climate change and its effects on water management at the urban-rural interface.

2. Using scenarios, to generate new knowledge on the upstream and downstream implications of urban water demand, and of resulting wastewater generation, as well as on water investment needs.

3. Prepare, in participation with city stakeholders and for the benefit of the most vulnerable groups, a strategic action plan for adapting to climate change based on improved water resource management

URAdapt was structured as two mutually reinforcing work packages: a multi-stakeholder platform for learning, reflection, feedback, strategy development and evaluation (work package 1; WP1); and an analytical research process, which included various types of studies and modelling (climate change, hydrological, socio-economic and institutional) (work package 2; WP2). The analytical research process which assisted in identifying solutions for the two city cases is described in the Methodology section. The research was discussed on an on-going basis with the platform which also participated in developing the city strategic agendas, mentioned in objective 3.
Objective 1 was met as confirmed in the process study that was undertaken at the end of the project. Objective 2 was met in terms of new knowledge generation using scenarios for climate change, urban demographic growth, and per capita water demand. New knowledge on water availability under climate change, urban flooding, and vulnerability of affected populations was generated which in turn was used to achieve objective 3. Unfortunately research related to water investment needs could not be addressed due mainly to lack of technical and financial resources to adequately study this aspect. Additionally the need for generating much primary data in the absence of a comprehensive secondary data set on economics of climate adaptation was a constraint. More details on the research are presented under the sections on methodology in chapter 3. The main findings of all research studies undertaken are presented in Chapter 4 under project activities.

A new objective that was met was to undertake a process study to (1) understand the evolution of the project in relation to the original project concept and notions, (2) obtain an initial qualitative measure of contributions, and (3) elucidate the features in its operational design that allowed for these contributions. To achieve these objectives a set of questions covering participants' interpretation of goals, interpretation of achievements and setbacks, the extent of leverage the project had, the strategies and tactics adopted and the concepts underpinning the project, was administered to project team and platform members using a semi structured interview mode, complemented by a documentary analysis. The objective was met and the findings of the study are presented in report form as part of the outputs. A summary of the key findings are presented in Chapter 6 under outcomes.

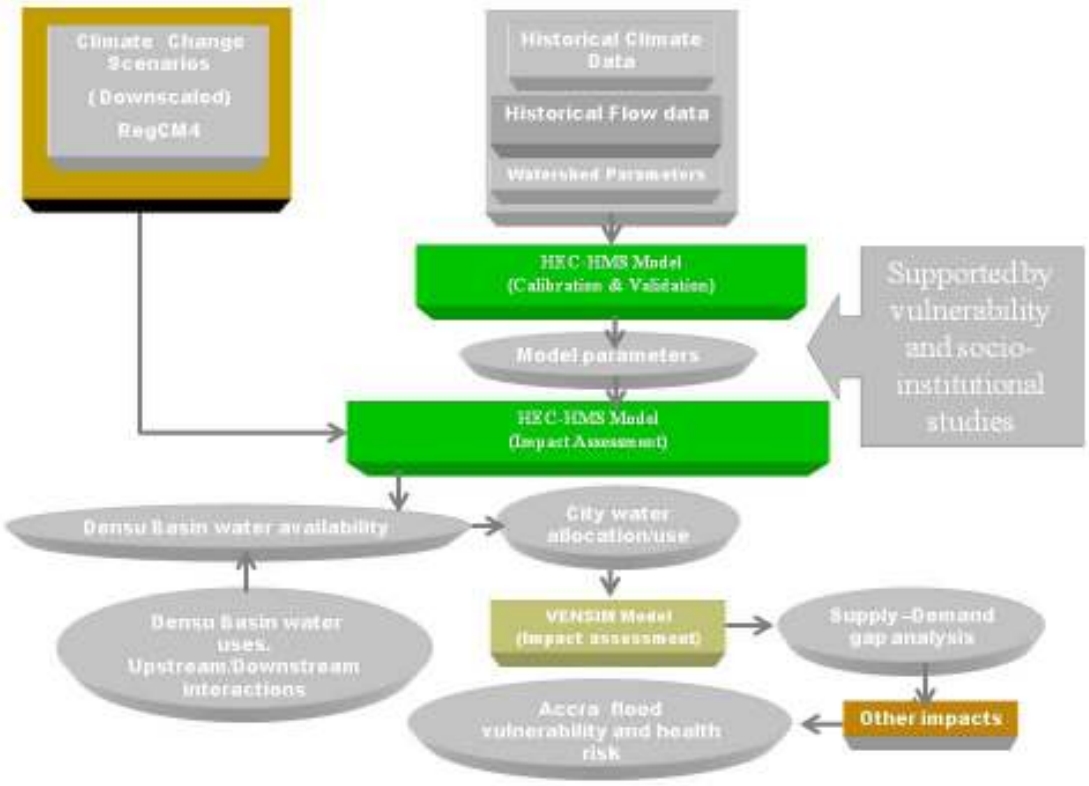
CHAPTER 3 - METHODOLOGY

Definition of the research framework

URAdapt devised an integrated analytical framework to produce new knowledge on climate adaptation in support of decision-making. The project took as its starting points the interdependencies between water sources, scales and sectors that cut across the urban-rural continuum. The knowledge generated through the various research studies in the respective cities, was consolidated into strategic recommendations for adaptation at the city level for the two cities.

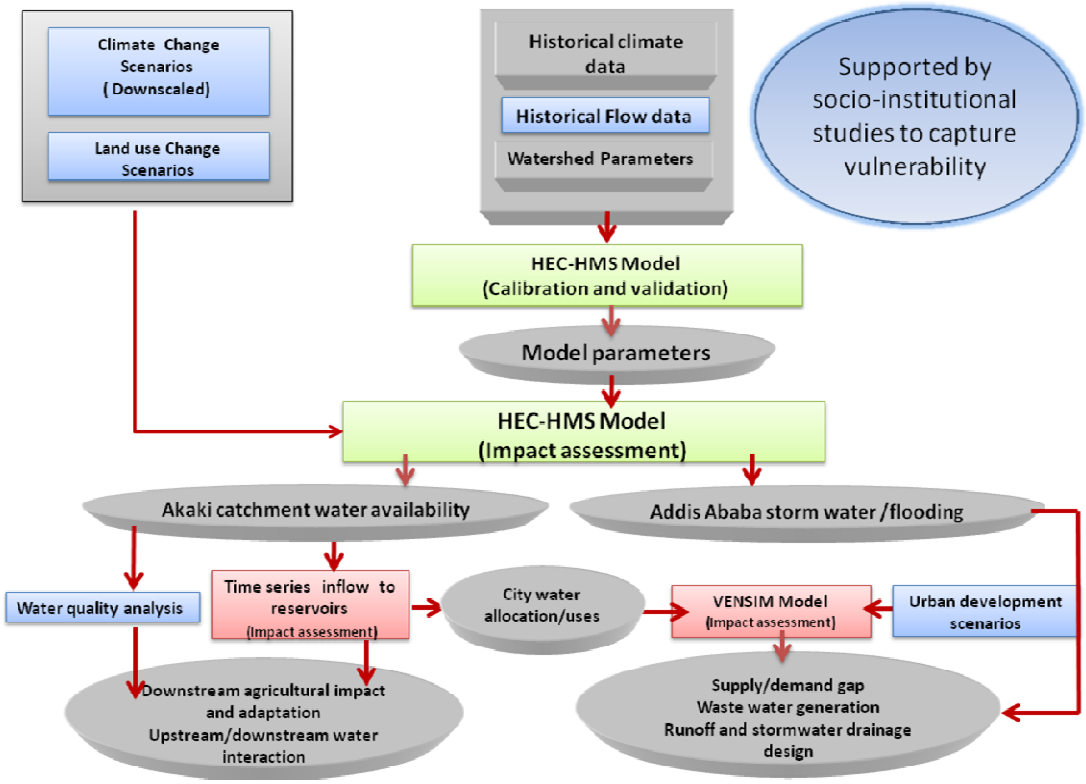
URAdapt has recognized that contextually relevant and sustainable solutions can only arise out of mutual learning and collective action. With this in view, the project applied a Participatory Action Research (PAR) approach, which involved setting up the Research into Strategic Action Platform (Re-SAP). This platform provided an opportunity for a novel constellation of stakeholders to come together to discuss how the two cities can reduce their vulnerabilities to climate change through improved and integrated urban water management. The Re-SAP has provided critical input into research activities through data provision, monitoring of progress, and evaluation of research quality and relevance. A smaller Consultative Group has provided strategic direction to the project, deliberating conceptual questions (such as the future of decentralization and privatization in the water and sanitation sectors in Ghana) that have implications for research content and uptake of research results.

In Accra, using regional climate models (RegCM4), URAdapt scientists downscaled global circulation models to the levels of the water basins serving Accra in order to understand their exposure to climate change under Intergovernmental Panel on Climate Change (IPCC) scenarios A1B and B1. This information was fed into a hydrological model (HEC-HMS) which projected water availability and allocation under different climate and basin water use scenarios. At the city level, URAdapt investigated urban water and wastewater interactions, including the water supply-demand gap under different scenarios of per capita water use and population growth, as well as the temporary water storage potential of Accra. Finally, the project also examined vulnerability in terms of exposure to flooding and the associated health risks for low-income communities.
The analytical framework that is schematically presented in the Strategic Agenda for Adaptation in Accra, is shown below for easy reference:



In Addis Ababa, using regional climate models (RegCM4), URAdapt scientists downscaled global circulation models to the level of the Akaki Basin, serving Addis Ababa, in order to understand its exposure to climate change under Intergovernmental Panel on Climate Change (IPCC) scenario A1B. This information was fed into a hydrological model (HEC-HMS) which modelled runoff in the catchment, and projected water availability and allocation under different climate and basin water use scenarios. At the city level, URAdapt investigated urban water and wastewater interactions, including the water supply-demand gap under different scenarios of per capita water use and population growth. Addis Ababa surface runoff was modelled using the US Soil Conservation Service (SCS)-based storm runoff model, and the impact of climate change on flood design parameters was studied. The project also examined vulnerability in terms of exposure to flooding and service levels for water supply and sanitation, and the associated adaptation responses of vulnerable communities, including those of downstream farmers exposed to poor water quality. Finally, urban-rural interactions around water use and management were studied with respect to Addis Ababa and the Finfinne zone surrounding it.

Schematically the analytical framework is excerpted from the Strategic Agenda for Adaptation (see list of project outputs) and shown below.


Climate Change Scenarios (Downscaled)
Land use Change Scenarios
Historical climate data
Historical Flow data
Watershed Parameters
Supported by socio-institutional studies to capture vulnerability
HEC-HMS Model (Calibration and validation)
Model parameters
HEC-HMS Model (Impact assessment)
Akaki catchment water availability
Addis Ababa storm water /flooding
Water quality analysis
Time series inflow to reservoirs (Impact assessment)
City water allocation/uses
VENSIM Model (Impact assessment)
Urban development scenarios
Downstream agricultural impact and adaptation
Upstream/downstream water interaction
Supply/demand gap
Waste water generation
Runoff and stormwater drainage design

Selection of stakeholder groupings (boundary partners)
Stakeholder selection was guided by two principles: the reflection of multiple perspectives on urban water management, and the participation of organizations and individuals in positions of incorporating project knowledge into policy debates and everyday working practice. More specifically, the project sought to enrol actors who could account for the following:

- the continuum of water use and management across urban and rural spaces (rural water supply, agriculture, irrigation), and reflect both the basin and national water resource management perspectives.
- climate change (climate change lead organization in the government, implementers of adaptation measures and disaster risk mitigation).
- socioeconomic factors that may compound vulnerability to climate change and be able to convey the voices of vulnerable women, urban slum dwellers and communities living in flood-prone areas.
- local-level water governance (urban and rural local authorities, including those in charge of water supply and wastewater in the two project cities).
- any health-related issues (including flooding and water contamination from poor sanitation).

The platform itself ensured that its composition continued to reflect the purpose of the project, and the in-built flexibility of the project ensured that new actors could be invited to platform meetings as and when needed. The specific tasks and operational mode of the platform were defined by stakeholders themselves. The Re-SAP also sought alignment with other water-related multi-stakeholder platforms in Accra and Addis Ababa.

Process for stakeholder engagement in order to have impact
The Re-SAP (Accra and Addis Ababa), Consultative Group (Accra) and Core Group (Addis Ababa), have served as the main channels for stakeholder engagement. Collectively, they have discussed findings and their implications for policy formulation and implementation, and in this way, continually provided further definition to the types of impacts that the project could pursue. As a sign of further commitment to the project, platform members themselves gave presentations and facilitated discussions at platform meetings.

In pursuit of wide-scale impact, the URAdapt project team and Re-SAP members have participated in climate change-related policy consultations and networked with communities of water management practitioners both in Ghana and Ethiopia. They represent a resource base that can be drawn upon in future work on climate change, water resources and cities.

At a more local level, URAdapt carried out targeted engagement with Accra Metropolitan Assembly (AMA) and the Addis Ababa Municipality respectively. In Accra, this involved focus group sessions with representatives of the waste management, sanitation, public health, urban roads, drainage, sewerage, town and country planning departments, and the development planning and coordinating unit. The project learned about the structure and functions of the AMA departments, as well as their information needs and data availability. In Addis Ababa, this involved learning about the structure and functions of the key departments, as well as their information needs and data availability. More focussed discussions took place with the city manager and his technical teams (particularly those related to water, sewerage and drainage), and the Addis Ababa Water and Sewerage Authority. As a result, the project was able to remain up-to-date on municipal initiatives and identify opportunities for integrating URAdapt research into the ongoing work of the local authority. The project also interacted closely with vulnerable communities as part of the case study analytical process.

In Accra, at the final stages, in support of the uptake of the research findings, one-on-one meetings were held with high-ranking officials of stakeholder organizations. This culminated in a policy roundtable with heads of key organizations and sector ministries. The outcomes of this roundtable may result in the 'resource base of individuals' facilitating 'intra-organizational' assimilation and utilization of project knowledge, through seminars or focus group discussions and visits to some of the at-risk communities. In Addis Ababa, the meetings were with high-ranking officials of the city municipality in particular including the City Manager and other key actors responsible for the implementation of the Agenda.

Inasmuch as the project proposal outlined very summarily the project methodology, the definition of the analytical research framework took place and was refined in the first year of the project. Subsequently the research studies to suit the development needs and data contexts of the respective cities were defined. Interestingly all of these studies were not identified at the beginning, but emerged as a result of the discussions and feedback from the platforms. The "organic" nature of the project which was cultivated provided the necessary flexibility in this regard. The health risk assessment study in Accra is a case in point.

Key research findings and recommendations

In this section for the purposes of this final report, we highlight some of the key findings, compare and contrast the cities and present the strategic directions proposed for informed decision making in the two cases. Detailed research findings are presented under Chapter 4 - Project Activities

Under the climate downscaling studies, whilst similar regional downscaling models were used, the type of analysis undertaken depended on the data availability. For Accra, climate downscaling results showed that the inter-annual rainfall in the basins feeding Accra are more pronounced with an increase in the frequency of drought years. Rainfall in April could decrease by up to 70% with implications for agriculture which in turn could impact on city water supply for one of the basins (Densu). Whilst the Densu showed reduced flow volumes of up to 10%, the Akaki basin in Addis showed likely increase in flows, and likely increase in flooding and extreme flood events. The expected reduction in flow in the Densu basin coupled with the fact that current extractions from the basin place it under water stress conditions, it was clear that present and future additional water supply would have to be sourced from the Lower Volta. In the case of storage reservoirs feeding Addis, the expected increase in flows was expected to translate into a significant increase in storage.

The impact of expansion of built area (non-climate driver) on urban hydrology was more substantial than that of increased rainfall alone. A nearly 20% increase in the runoff coefficient, due to built-area expansion was observed over the last 20 years, which represents a 62 % increase in runoff volume for Addis Ababa. In Accra risk maps produced using the baseline information available with recently flooded areas super-imposed indicated that new urban areas are subject to flooding mainly due to poor and under-designed drainage. In Addis Ababa, this phenomenon was further quantified by evaluating the change in return periods for peak floods. Results showed for example that the 10 year return period floods in the 1990s is equivalent to a 2 year return period of flood in the 2030s, with implications for the design criteria and standards used for urban storm drainage networks(Table 1 below).

Studies on how urban water systems are impacted show that, for both cities, there is a distinct supply demand gap with supplies not being able to meet even current demands. Whilst plans are in place in both cities to increase the supply, these are seen to be inadequate. In Accra, the planned expansion is inadequate to meet the demands of even a low growth/low water usage scenario. Water to meet these demands is available in the Lower Volta but additional investments are necessary. In Addis the supply demand gap is less immediate, but even with additional planned increases, the 2030s will see a gap which can be filled only by sourcing water from further away. This

is because the city is located at the head end of the basin and the reservoirs serving Addis Ababa have their storage limits.

Any shift in the non-climatic drivers (i.e. population and per capita water demand) will widen the gap. This is true for both cities. High physical losses due to badly maintained pipe networks exacerbate the problem. 20% is a conservative estimate of such losses in Addis Ababa with the figures being higher for Accra as secondary data shows. This gap is met temporarily in Accra through buffer storage generated by hard plastic storage tanks known as Polytanks, in households. This buffer amounts to one day's production from the water utility. In Addis it was shown that up to 34% savings can be made through water conservation measures, and the use of water saving technologies. Wastewater generation in both cities will increase as expected with the increased water use, but the downstream impacts are much more immediate in Addis Ababa. The Akaki River serves farmers and livestock downstream of the city and the changing weather patterns are causing unanticipated seasonal increases in pollution loads in the river leading to livestock death and livelihood losses.

In Accra the rural-urban interactions are manifested through the expected increased use of water for agriculture under drying scenarios in a basin (Densu) that is already water stressed. In Addis Ababa these interactions are more targeted to the Finfinne zone (and not to a basin), which has a symbiotic relationship with the city. Changes in water use in the Finfinne zone will have implications for common water resources. Presently these concerns are not addressed in any organised way but the institutional analysis has shown that a framework for coordination exists but needs to be implemented. Table 2 shows the case findings.

The health risk assessment of a flood vulnerable community in Accra highlighted the seriousness of the health risk faced by these communities as a result of the inadequacy of water and sanitation services. Analysis of drinking water and soil samples showed higher levels of contamination particularly after flooding, exposing both children and adults to health risk. Children were seen to be particularly vulnerable.

Human and institutional vulnerability to climate change and the potential for adaptation focussed in Accra, on flood vulnerability from a community perspective and assessment of health risk. At risk communities were seen to be capable of articulating their adaptation needs but local governance and planning processes were not geared for their participation in decisions. Prioritising spatial planning and implementation of existing zoning and land use plans was identified as a critical lapse in flood management. Unacceptable practices for waste disposal, aggravates flood and health risk.

In Addis Ababa, community vulnerability was assessed in terms of access to services (housing, water supply, sanitation, infrastructure), and exposure to flooding. These studies were supplemented by an analysis of the vulnerability at the city level in terms of physical and socio-economic factors. Communities were found to be vulnerable to different degrees, and showed diverse scoping strategies. The worst affected communities from a flood perspective were Akaki-Kaliti, Lideta, Arada, Nifas-Silk-Lafto and Cherkos. Some of these same vulnerable communities (Akaki-Kaliti, Cherkos, Yeka and Arada) showed extreme income poverty as well. These communities also either lacked services or were very poorly served from a water supply and sanitation perspective.

In Addis, an assessment of the adaptation capacity of organisations and institutions was undertaken through a policy and institutional review. On the plus side it was seen that national institutions and processes provide a supporting environment for responding to climate change adaptation, and this is reflected also at the city level. Additionally communities showed a strong willingness to participate and contribute to the planning and implementation of adaptation programs and that there were informal risk sharing schemes. The weakness was seen in the low implementation capacity across levels of government and sectors.

A few policy weaknesses were also identified. Policy instruments that would encourage use of water efficient technologies, and policies supporting full cost recovery in water service delivery, that would contribute towards curbing wastage especially of large domestic users, were lacking. There was no wastewater management policy, nor was there an effective agricultural policy that supports urban agriculture where treated wastewater could be recycled, that leaving fresh water for other beneficial purposes.

In Accra the institutional analysis showed that both the climate change and the decentralisation policy were in a state of flux, which was undesirable since the latter is an important element for the success of the former. The lack of a single point of coordination with dedicated capacity and resources was a limitation in moving the climate agenda forward. Sector policies and strategies do not yet address climate change and adaptation effectively. Water allocation and management decisions would be enhanced with public/community participation but institutions were not sufficiently flexible to respond to this need. Basin water management was still incompletely decentralised, therefore they lacked resources. The overlap between flood management and flood response interferes with clear definition of mandates and responsibilities at national and local level.

Strategic Agenda

The consolidation of these findings produced 3 strategic objectives for each city which form the basis for informed decision-making

These centred on water supply and demand management, flood risk management and community adaptation, and wastewater management. In Accra given the weak coordination for mainstreaming climate related actions, an additional objective was the strengthening of institutional capacities to address water related climate change impacts.

The need for community involvement for successful adaptation to flood impacts was recognised in Accra and a number of recommendations were made to that effect. Both cities highlighted the need for improved coordination and better flood management plans, including plans for resettling communities in the worst cases. Implementation of spatial planning and regulations was also critical to adaptation. Education and awareness creation on the health consequences during flood episodes was advised, and measures to protect vulnerable populations were recommended. In addition, redesign of urban drainage infrastructure to cope with the increase urban surface flows resulting for an increase in the built environment and from climate change was an important recommendation. This emerged through studies in Addis, but the recommendation is equally valid for the Accra case. Other infrastructure interventions were retention basins in upstream areas to delay the flows and avoid flooding.

In both cities recommendations centred around practical ways of reducing the supply demand gap in relation to water to cities and using effective policies and policy instruments. These included water saving and conservation, pricing mechanisms, and water investments. Additionally though, whereas for Addis, many of the recommendations were specific to actions at the level of the city water authority, which had responsibilities to supply and distribute water, in Accra the recommendations were directed to the national and basin levels. Both cities called for integration and coordination between city and regional authorities and at the basin level (in the case of established water basin authorities) as being important an important response to climate adaptation.

Wastewater management was seen as critical in Addis since the effect on downstream communities was aggravated. In Accra, the geographic location of the city in a coastal area, had less widespread impacts on downstream users though coastal pollution occurs (this aspect was not included in the project). Enforcement of existing regulations and use of incentive based policy instruments to curb industrial pollution were also suggested recommendations. Additionally the sale of treated

wastewater for use by downstream farmers was advocated as a good business measure to combat pollution, which in turn would reduce the health impacts related to flood waters.

In Accra a strong case was made to improve coordination in relation to climate initiatives, to strengthen the capacities of decentralised entities to plan for and manage climate change, and to strengthen the policies that deal directly with water and water related activities, to incorporate climate adaptation. This was also true for Addis but to a lesser degree as at the time of the studies, climate adaptation was already a priority due to the active role of the then prime-minister, in the climate discussions.

The detailed recommendations are found in the respective City Strategic Agendas for Adaptation contained in the list of outputs.

CHAPTER 4 – PROJECT ACTIVITIES

Essentially the available resources were used to support the two work packages as originally designated in the project proposal.

Work package 1: Research to Strategic Action Platform (Re-SAP) activities.

As presented in the Gantt chart below, the activities and timelines are self-explanatory. However a few reflections on the activities are pertinent.

Institutional analysis and stakeholder identification: this step was found to be crucial to the setting up of the platform as a clear understanding of the existing institutional environment and the roles and responsibilities of stakeholders was necessary for the selection of platform members. The credibility of the platform depended on this. Skills and expertise for this activity must be built into a research team that prepares a project in participatory mode. Much documentation is already available in relation to institutions of the urban water environment which can be useful for this exercise. A further important related activity was the mapping of existing climate change projects and initiatives in order to identify the types of linkages and networking that would be necessary. This in turn led to a later activity for mapping the water and climate sectors and the key players to gain a better understanding of the socio-political and institutional environments of these two sectors in order to influence adaptation policy, and the implementation of the city strategic agendas.

Stakeholder consultations and setting up of platform: Maintaining flexibility in relation to the structure and functioning of the platform was critical to its success. This flexibility allowed the setting up of subgroups within the platform which could co-opt the right mix of stakeholders for more specific roles and responsibilities vis-a-vis the project. Thus the emergence of the "consultative group" in Accra, and the "core group" in Addis Ababa, described in more detail in the Interim reports. Similarly platform composition could be expanded on the basis of stakeholder suggestions when relevant. This happened a few times when new potentially important stakeholder groupings were identified.

Participatory monitoring and evaluation and outcome mapping: Though impact pathway analysis was mentioned in the project proposal, no such activity was undertaken with the stakeholders. We attempted to use outcome mapping as the participatory evaluation tool supplemented by a KASA questionnaire. We had partial success with this tool in Accra, but were unable to apply this in Addis Ababa, due to the lack of skills in the project team, on the use of the tool, in spite of some preliminary training provided by IDRC to project team members.

Platform meetings to review progress: Review of progress required that the project team had new information to present at each of the meetings. The number of these meetings varied in the two cities depending on the level of advancement of the research studies undertaken. A further factor was the constraints that partners faced in organising the meetings. In all, 7 full platform meetings took place in Accra and 5 in Addis Ababa. Very useful feedback was obtained, with such participation also leading to some partners playing a more active role in the research. Thus one stakeholder organisation subsequently became a member of the research team carrying out a flood vulnerability study in Accra.

Present scenario results to national policy and decision makers & develop recommendations: Policy actors present on the platform helped shape the strategic agendas for the two cities. A hierarchical targeting for policy influence was the case in Accra, where platform members suggested that the next higher level of policy actors (their bosses) would have to be engaged first before moving to still higher levels. The importance of process and processes was also recognised, with clear indication that understanding policy influencing processes was the first step in translating research to policy, and that a clear step by step process outlining actions needed, would be required. Thus prior to the final policy roundtables with high-level actors a number of one to one meetings with key actors were required in the two cities.

Capacity building of staff from partner institutions & Research-Strategic Action Platform: It should be mentioned here that partner institutions actively participated in and were responsible for the research studies as part of the city research team. The sharing of knowledge within the team was in itself a capacity development experience. Furthermore a joint write-shop and learning forum was organised at the end of project which gathered the research team members from the two cities, thus contributing to their own self-development as part of a team. IDRC also organised various training sessions in which members of the research teams participated.

On the other had members of the platform had their knowledge on climate change and its consequences for development enhanced through presentations that were built into the Re-SAP meetings. Thus they were sensitised to climate change and its consequences, climate downscaling, hydrological and water allocation modelling, dynamics of urban development, flood vulnerability and related health impacts, climate policy and governance. These presentations were wither made be project team members or invited speakers.

Project team members also organised training workshop on the use of the water balance modelling (VENSIM model application), climate downscaling, and hydrological modelling for representatives of industry and students from Addis Ababa University.

Developing strategies for urban resilience: it is interesting to note that strategy development was an activity that was part of the participatory action research approach adopted by the project. Based on a draft strategic framework developed by the research teams, working groups from the platforms in the respective cities, contributed substantially to the development of the strategic agendas. This was understood to contribute to the commitment that institutions would show for the uptake of some of the recommendations, as some of these same organisations were designated to implement parts of the Agendas.

Work package 1: Research to Strategic Action Platform (Re-SAP) activities

Time	Project Year	Year One				Year Two				Year Three				Status
	Project Quarter	1	2	3	4	5	6	7	8	9	10	11	12	
	Calendar Month	Aug-Oct	Nov-Jan	Feb-Apr	May-Jul	Aug-Oct	Nov-Jan	Feb-Apr	May-Jul	Aug-Oct	Nov-Jan	Feb-Apr	May-Jul	
	Calendar Year	2009	2009-10	2010	2010	2010	10-11	2011	2011	2011	2011-12	2012	2012	
Work Package One: Research-Policy Platform														
1.1	Institutional analysis, stakeholder identification, project partner meeting													100%
1.2	Initial stakeholder consultations & setting up of platform and/or expanding existing one													100%
1.3	1st platform meeting, analysis and agreement on impact pathway and M&E system													100%
1.4	Platform meetings to review progress													100%
1.5	Present scenario results to nat. policy and decision makers & develop recommendations													80%
1.6	Capacity building of staff from partner institutions & research-policy platform													100%
1.7	Developing strategies for urban resilience													100%

Work Package 2: Analytical Research

Time	Project Year	Year One				Year Two				Year Three				Status
	Project Quarter	1	2	3	4	5	6	7	8	9	10	11	12	
	Calendar Month	Aug-Oct	Nov-Jan	Feb-Apr	May-Jul	Aug-Oct	Nov-Jan	Feb-Apr	May-Jul	Aug-Oct	Nov-Jan	Feb-Apr	May-Jul	
	Calendar Year	2009	2009-10	2010	2010	2010	10-11	2011	2011	2011	2011-12	2012	2012	
2.1	Inventory of available climatic and hydrologic models (properties and usefulness). Decide on model use.													100%
2.2	Define main scenario types.													100%
2.3	Data collection: climatic data generated from downscaled climate scenario results													100% (Addis) 100% (Accra)
2.4	Data collection: demographic data and urban water system													100% (Addis) 100% (Accra)
2.5	VENSIM model development													100% (Addis) 100% (Accra)
2.6	Data analysis and modelling of scenarios													100% Addis 100% Accra
2.7	Generating and incorporating feedback from platform													100% (Addis and Accra)

	Finalize scenarios for adaptation in collaboration with stakeholders													100% (Addis) 100% (Accra)

The activities supported under work package 2 are listed in the Gantt chart with their respective timelines. These were sometimes pushed to accommodate delays in data collection and analysis. It must be understood that whilst the general topical areas of research (climate downscaling, hydrological and water balance modelling, vulnerability socio-economic and institutional analyses, water availability, and urban rural interactions in relation to the water cycle) were outlined, the actual research studies were defined and refined by the platform members with their knowledge of local needs and data availability. The research studies conducted in the two cities and the key findings of the research are presented here for easy reference.

As indicated earlier all research from this work package was shared with the Re-SAP platform and was reviewed by the stakeholders.

Table 1: RESEARCH THEME: CLIMATE DOWNSCALING AND IMPACT OF CLIMATE AND NON-CLIMATE DRIVERS ON URBAN HYDROLOGY

City	Research/Study Topic	Main Findings/Likely Scenario
Accra	Climate Downscaling of the DENSU and AKOSOMBO sub-catchments	· General drying conditions projected for future climate.
		· Interannual rainfall variability is more pronounced and the SPI also indicates an increase in frequency of moderate to severe drought years for the future in the Densu
		· Dynamic downscaling of ECHAM5 emissions scenario IPCC A1B and B1 show that in April, which is the usual transition from the dry to the rainy season, precipitation will decrease by up to 70% and the duration of the rainy season will narrow, which may have extensive implications for agriculture and city water supply
	Impact of climate change on water availability in the Densu Basin	· 10% reduction projected for Densu streamflow
	Baseline Water Availability and Use in the Densu Basin	· Current total annual water abstraction is 34% of Densu's annual streamflow-basin already in water stressed conditions.
		· Water abstraction upstream of the Weija dam is small, just 1% of basin streamflow.
	Flood risk mapping in the Greater Accra Metropolitan Area Of Ghana	· Baseline urban flood risk maps were produced with overlay of current flood prone areas. Some floods are occurring even in the lower risk areas due to inadequacy of the storm drainage networks in the built areas.
	Surface water availability in the Lower Volta basin.	· More than enough water in the Lower Volta to cater for all of GAMA's current and future requirements for potable water.
Addis Ababa	Evaluation of impact of climate change on the extreme flow hydrology and water availability of Akaki Basin using different emission scenario.	· Likely increase in flow volumes and likely increase in flooding.
		· There will be a 13% increase in 2030s and a 15% increase in 2090s in the annual flow volume of Akaki.
		The extreme floods will likely increase by 37% in 2030s and by 15% in 2090s.
	Evaluation of impact of climate change on the water supply reservoirs of existing Gefersa, Legedadi and Dire dams and other future water supply sources to Addis Ababa.	· Inflows to and storage in the three reservoirs are likely to increase significantly.
		· Inflow to Legedadi increases by 14 and 16% for 2030 and 2090 respectively whilst the storage increase in the reservoir is 21 and 19% respectively (significant).
		· Inflow to Dire increases by 9 and 3% for 2030 and 2090 respectively whilst the storage increase in the reservoir is 26.5 and 24% respectively (significant).
		Inflow to Gefersa increases by 5 and 4% for 2030 and 2090 respectively whilst the storage increase in the reservoir is 38 and 37% respectively (significant).
	Impact of built environment on hydrological regimes of Addis Ababa.	· The non-climatic driver of increase in built environment has increased the runoff coefficient from 28% to 45% over the last 20 years with continued increase expected in the foreseeable future.
		· In terms of volume, this represents a 62% increase in runoff volume within Addis Ababa.
		With the rapid changes observed in the built area, flood volumes are anticipated to be currently higher.

	Mainstreaming climate change impact in the design of urban drainage infrastructure.	· The return periods of peak floods have changed and so the design guidelines for drainage infrastructure have to be revised.
		· 10 year return period floods in 1990s (60.1m^3/s) is equivalent to 2 year return period of flood in 2030s (61.2 m^3/s). This is equivalent to about 5 years return period of flood in 2090 (62m^3/s).
		Similarly the 50 year (72 m^3/s) and 100 year (77 m^3/s) return period of floods become 5 years and 10 years return period respectively in 2030s.

Table 2: RESEARCH THEME: URBAN WATER SYSTEM TRAJECTORIES AND IMPACTS

City	Research/Study Topic	Main Findings/Likely Scenario
Accra	Water Storage Capacity in Urban Accra	• Urban temporary water storage systems within GAMA have enough capacity to store a day's production of Ghana Urban Water Company Limited. • The storage explains how the Supply-Demand gap is temporarily bridged. • Buffer storage for managing Supply-Demand gap is biased to the high income group who are therefore less vulnerable to the water shortage situation.
	Water Supply and Demand Situation Modeling using VENSIM	• Planned water supply development for GAMA is inadequate even to meet the minimum water demand scenario of 3.1% population growth and 60 l/c/d consumption, for Accra. • A shift in any of the non-climatic drivers will increase the water supply-demand gap of Accra. • High physical losses in the system exacerbate the supply demand gap.
Addis Ababa	Evaluation of water and waste water management under impact of climate change for Addis Ababa city (Using VENSIM Model).	• Current water supply provision is not adequate for Addis Ababa City. There is a gap of 28% between supply and demand which has to be met. • Despite additional planned water supply development, by 2030, the water supply of Addis Ababa City will still be insufficient due to the increased demand related to temperature rise, demographic growth and the improved well-being of people. For an average scenario of per capita water demand, the gap between supply and demand is expected to 47%. • If expected demand is met, wastewater generation in the City of Addis Ababa will triple by 2030. Of the net supply water, 17.5% is consumed by 107 consumers.

	Assessing water conservation and management options for meeting increasing water supply-demand gap in Addis Ababa City.	• A net gain of 34.4% of water to bridge the gap, would be possible with water conservation and management measures. • Current non-revenue water is about 39.5% (unaccounted for water in the distribution system). • Most of the water distribution facilities are old and badly maintained. 20% of the water can be gained through replacing old fixtures with efficient ones.
	Understanding the situation of waste water irrigation in the Akaki catchment.	· The quality of water in the Akaki River has deteriorated over the last 40 years. · Waste water generation has increased the availability of water for vegetable production in dry seasons. · Unexpected intensity of rainfall during the dry season and at onset of the rainy season increases pollutant levels in the Akaki River. Consequently frequency of cattle sickness and death increases. · 75% of the annual income of farmers is derived from waste water irrigation in the dry season. · Farmers seek other sources of income during the rainy season due to flooding of farm lands. With climate change and expansion of built environment, the period of flooding will likely expand.
	Investigation of up/downstream linkage in relation to the urban water cycle for the city of Addis Ababa.	· There will be competition for groundwater use from Akaki well field (serving Addis Ababa), for the surrounding areas, due to urbanization and industrialization. · 20-25% of the population in the Finfine zone is urban with increasing water needs. · There is a large livestock population using rural water sources, which already face water shortages in the dry season.

Table 3: RESEARCH THEME: HUMAN AND INSTITUTIONAL VULNERABILITY

City	Research/Study Topic	Main Findings/Likely Scenario
Accra	Quantitative Microbial Risk Assessment of Gbegbeyise	· All indicator organisms (E. coli, faecal streptococci and faecal coliform and Cholera spp) were low in population counts or not present in Gbebu (a shallow well sometimes used by inhabitants for domestic purposes) before flooding. · E.coli and faecal streptococci population levels increased significantly after floods from 0 to 1.9 x 10-5 to 2.3 x 10-4. These levels exceed the standards for inland waters for bathing (9.0 x 102 and 3.3 x 102 (cfu 100 ml-1) for E. coli and intestinal Streptococci, respectively) · Levels of faecal coliforms, E. coli and faecal streptococci estimated in flood water in Gbegbeyese were relatively lower than the stream water which was highly polluted. · Faecal coliform and E. coli in soil samples collected from flood prone areas increased significantly by 1.3 log units, after flooding. Similarly Vibrio. parahaemolyticus populations increased from zero before flooding to 3.97 log units after flooding. · Varying levels of Vibrio spp were found in drinking water samples. These pathogens are not expected to be present in any drinking water source. Drinking water samples collected did not meet the standards for potable water.
	Hydro and Climate Institutional Mapping	· Climate change and decentralization (local government) as policy issues are in a state of flux. Both the climate policy framework and the climate adaptation strategy have been critiqued in their drafting for lack of an inclusive process · There is no single point of coordination and direction, with dedicated core capacity and expertise thus limiting the framing of climate related issues. Various interventions are donor initiated and not responsive to local needs. · The macro-policy environment has paid heed to project-relevant themes, discursively if not effectively. Sector policies and strategies on agriculture, water and health sectors do not address climate change specifically but climate variability. · Mainstreaming climate change into the development agenda and MTDPs requires capacities and climate leadership skills at the level of the NDPC and the local level. · Resource constraints (finances and human) limit the enforcement capacities of responsible institutions such as local government (AMA) and local level TCPD. · A deep research-policy gap exists, due to poorly articulated knowledge needs. The evidence base for informed decision on climate related issues requires to be strengthened through policy change on climate adaptation information systems · There is some degree of overlap between organisations dealing with flood management and flood response leading to a lack of clarity and direction both at national and local levels. · The Densu Basin board is not adequately resourced (financial and technical skills) to respond to climate influenced decisions on basin water management. · Water allocation by permit system provides sufficient flexibility to adapt to changes in water availability at the basin level, and should be used more effectively at basin level as an instrument for adaptation to climate change. · There is inadequate institutional flexibility for stakeholder participation in water allocation and management decisions.
	Community Adaptation to Flooding Risk and Vulnerability.	· Communities are capable of articulating their adaptation needs which are not yet integrated into the local development planning process. · Local level involvement in the development planning process stops at the district level due to lack of resources but should be decentralized further · Spatial and land use planning is critical for managing flood related risks but is not sufficiently prioritized in terms of implementation at national and local levels

		· Poor attitude to waste disposal and management are a contributory factor to increased flood risk and health risk at community level. · Waste management is a decentralized function but there is inadequate investment. · There is a strong base of local knowledge of community members to tackle vulnerability and flood management as well as early warning signs.

Table 3 (contd): RESEARCH THEME: HUMAN AND INSTITUTIONAL VULNERABILITY

City	Research/Study Topic	Main Findings/Likely Scenario
Addis Ababa	Assessment of the physical and socioeconomic vulnerability of Addis Ababa to water-mediated impact of climate change (water supply, urban flooding and waste water management).	· Differentiated vulnerability of communities to flood incidence and diverse coping strategies adopted:
		–The city experienced severe flood at least 25 times between 1978 and 2010. Excluding the downstream Oromiya district, at least 15,000 people were severely affected. 58% of the population living close to the bank of Akaki river have low quality houses and are more vulnerable to flood incidence (from secondary data sources). *–38.7% of people in Addis Ketema, 32.2% in Akaki-Kaliti and 30.8% in Arada sub cities are exposed to flood incidence. Sub cities of Akaki-Kaliti, Lideta, Arada, Nifas-silk-Lafto and Cherkos are the most exposed.* *– Some adaptation responses of vulnerable communities to floods included reinforcing river banks, changing cropping patterns, cleaning drains, sheltering affected people in community shelters as well as forming strong social networks as a risk insurance strategy.* *– The downstream farming communities (4108 farm households) involved in peri-urban agriculture (3560 hectares and substantial livestock) are vulnerable to crop failure and livestock deaths from flooding and water logging problems (33% of respondents reported severe flood damage.*
		· Urbanization, poverty levels and low access to basic social services and housing makes the city and its populations more vulnerable
		– The city more than doubled its built up area from 1975 to 2000 showing a physical expansion from 6050 to 14,672.7 hectares. . *– With a projected city population of 5 million by 2030, migration to the city is seen as a major contributor (46.9%).* *– 24.8% of houses in the city are in a very poor condition increasing their vulnerability to climate extremes.* *– 32.5% of the population of Addis Ababa are living below the poverty line. The most vulnerable communities due to their extreme income poverty live in Akaki-Kaliti, Cherkos, Yeka and Arada*
		· Current level of development makes the city more vulnerable to water supply and sanitation deficit, with different level of exposure among different social groups:
		– 27% of the population of Addis Ababa does not have access to improved water supply. Any future reduction in water supply will exacerbate their vulnerability. The 73% with access will also be affected but to a lesser degree. *– In the very poorly served sub cities of Akaki-Kaliti, Gulele and Arada, between 40 and 47% lack access to improved, affordable and sufficient water supply. In better served areas like in Addis Ketema, Gulele, Kolfe Keraneo and Arada , about 35% of population are subject to interruption of water services.* *– 83% of the city population use pit latrines while only 17% of the population in high income areas have access to flush toilet. Particularly in the Akaki-Kaliti, and Cherkos sub cities, between 85 and 90%, of the population have only basic sanitation services.*

		– *Additionally, low income areas with pit latrines, which are at risk from flooding, face potential health risk.* – *Less than 15% of the urban area is sewered. 30% of solid waste is dumped in open spaces, river banks, road sides etc.*
		· Existing road infrastructure of the city is more vulnerable to flood due to the likely increase in intensity of rainfall and under-design of drainage systems.
		– *Out of the current road networks of 3324 km in the city, about 1662km of asphalt is vulnerable since impact of climate change was not considered during construction.*

Table 3 (contd): RESEARCH THEME: HUMAN AND INSTITUTIONAL VULNERABILITY

City	Research/Study Topic	Main Findings/Likely Scenario
Addis Ababa	Review of the policy and institutional arrangements to assess the adaptation capacity of the city to water mediated climate change impact.	The policy and institutional analysis identified the following features (strengths and weaknesses) that influence the capacity of the city to adapt to water mediated climate change impacts.
		• National institutions and processes provide a supporting environment for adaption to climate change:
		–*Though climate change is not directly mainstreamed in the Growth and Transformation Plan (GTP) of the country, the overall development goal of eradicating poverty, as stipulated in it, is a strength that builds the city's adaptation capacity. The medium term plan focuses on pro-poor development addressing the most vulnerable segments of the city.* – *Climate change is internalized, albeit indirectly, in the existing environment, water resource management, disaster prevention, preparedness and early warning policies and the health policy.* – *International donor aid for development provides opportunities for financing climate change adaptation programs*
		• At the city level, the existing constitution, institutional arrangement as well as the organisational structure of the administration, reflects or creates more capacity for the city to adapt to water mediated climate change impacts**.**
		– T*he constitution and the water policy provides the city the right to utilize the water resources within and outside its boundary; There is provision for establishing a special joint committee with the neighbouring Oromiya region for resource utilization and regulating discharge of pollutants.* – *Mandates are clearly identified for at all levels of institutional structure including at federal, city, sub city and district levels.* – *The city is autonomous and prepares its own sectoral policies, strategies and development programs; it allocates a budget to development programs, and follows-up on implementation. For effectiveness of such mandates, the city has its own decentralised structures that stretch from city to district levels.* – *There are informal community risks sharing schemes, which are organized by members, led by democratically elected leaders that provide insurance service to members only.* –*There is strong willingness of the local community to participate and contribute in planning and implementation of adaptation programs to build their resilience to climate change. Better design of adaptation programs is possible with local community participation (results of focus group discussions).*
		• Some implementation gaps were identified that may weaken the adaptive capacity of the city.

	– Though the special committee for water resource management between Addis Ababa and Oromiya region has been established; clear mandates, processes and related institutional arrangement are still lacking to make it functional. *– Low implementation capacity across different organizations at the city level. This is reflected in poor planning, low implementation of targets, poor enforcement of existing policy (e.g. pollution), low motivation of district officials and low coordination capacity (e.g. between AAWSA and AACRA).* *– Narrow revenue base (business tax, non-public employee tax, etc.) and low revenue collection capacity (at city level) impedes adequate budget allocation for climate adaptation.* *– Low awareness of local community about water mediated climate change impact.* *– No clear understanding for integrating development plans with climate adaptation plans.* *– Early warning system exists at city and sub-city levels, but there is no involvement of the local community in planning and implementation.* *– The command-and –control policy of environmental pollution cannot be implemented due to institutional weakness.*
	· Policy and institutional gaps that are likely to affect effective adaptation are:
	– The water resource management policy ignores efficiency in tariff setting as it only considers the full cost recovery of the investment and operation and maintenance costs in water service delivery. *– There is no policy instrument that encourages use of water efficient technologies.* *– There is no wastewater management policy and the existing wastewater treatment plants in the city have no mandate to sell or recycle treated wastewater (as a possible adaptation option).* *– There is no urban agriculture policy and strategy. This hinders the productivity of the sector and use of safe wastewater irrigation despite the huge volume of wastewater production and the willingness of urban farmers to buy and do safe wastewater irrigation.* *– There is low private sector participation in waste management, which could improve service levels.* *– Absence of formal insurance schemes for climate related risk management.*

PROJECT IMPLEMENTATION AND MANAGEMENT

What was learned about the implementation and management of the project's activities? Were certain aspects of project management and implementation particularly important to the success of the project?

Looking back at project implementation and management, 4 key principles stand out via: partnerships, disciplinary orientation, engaging with/involving users, and understanding processes. Each of these principles is expanded the learning achieved is discussed.

Working through Partnerships

The core activities of URAdapt were implemented through a partnership between the International Water Management Institute (the main partner), the Water Research Institute (WRI) of the Council for Scientific and Industrial Research (CSIR) and the Addis Abeba University. An additional layer of partners constituted the research-strategic action platform (Re-SAP; work package 1). These are project stakeholders (boundary partners), who can influence and/ or be influenced by the project. They defined the parameters of the analytical research activities by providing data inputs and information on data availability. These partners also collectively formulated evidence-based adaptation strategies and deliberated their practicability.

A further tier of partners included policy and decision-makers, such as sector ministries. These stakeholder organisations provided their contributions and kept abreast of project developments through the various agencies and departments that they oversee and that are platform members. While not involved in the immediate knowledge generation activities carried out by the platform, they were critical to putting 'knowledge-into-use' through policies, programmes or practical interventions. As a group they were later also targeted through one to one meetings and a final policy roundtable. In addition, following on the Accra inception workshop, a Consultative Group was set up which provided strategic inputs for the preparation of platform activities, and act as advocates for the project.

An important element of the project was the direct involvement of partners in the actual research studies with in some cases full responsibility for the quality of outputs. This was not a commonly utilised model by the main implementer, the International Water Management Institute.

Disciplinary orientation

URAdapt was multi-disciplinary in nature. Work package 2 (the analytical research component of the project) includes climate, hydrological and other forms of modelling, as well as studies on the socio-economic, aspects of the impacts of climate change on urban water and allied sectors, and vulnerability analyses, supplemented by an analysis of the policy and institutional environment.

The project team and partners had expertise in some areas such as hydrological and climate change modelling; water allocation, urban water management, sanitation and agriculture; multi-stakeholder processes; and economic analyses. Consultants for some research studies (e.g. the University for Development Studies, Ghana, for climate downscaling in Accra) were also recruited, who stayed associated for much of the duration of the project, in order to contribute to the development of the strategic recommendations. Such consultants were also called upon to participate in some planning and learning activities of the project team.

Interdisciplinary exchanges between team members and cross fertilisation between the two city research teams allowed for rich exchange of ideas. For instance the analytical frameworks developed in one city context fed into the reflection around the studies in the other. There was also sharing of experiences albeit electronically, on climate downscaling models and methods. As indicated earlier the project culminated in a joint write-shop and learning forum for the two research teams. It was

acknowledged that in such types of research projects, increased contact and exchange of knowledge between country teams enriches the final outputs.

Importantly, the project recognised the expertise of non-research stakeholders, such as policy actors and decision-makers as well as vulnerable and affected communities. Their knowledge was brought to bear on the project through the multi-stakeholder platform.

Involvement of research users or ultimate beneficiaries, or their representatives
Stakeholder input is critical to *designing the analytical research activities, formulating subsequent evidence-based adaptation strategies, and monitoring progress.*

The platform was the main arena for soliciting stakeholder contributions (through Participatory Action Research). Besides stakeholders representing different entities in the urban water sector, climate sector, and local government; the platform consisted of representatives of vulnerable groups, such as urban slum dwellers and residents of flood-prone areas, along with an expert in gender and climate change. See below a table of the composition of the stakeholder platform.

Re-SAP platform representation

Actors able to account for the continuum of water use and management across rural and urban spaces (rural water supply, agriculture, irrigation)
Actors able to account for climate change (climate change lead organisation in government, implementers of adaptation measures and disaster risk mitigation)
Actors able to account for socio-economic factors that may compound vulnerability to climate change and able to convey the voices of vulnerable women, urban slum dwellers and communities living in flood-prone areas
Actors able to account for local-level water governance (urban and rural local authorities, including those in charge of water supply and wastewater in the two project cities)
Actors able to reflect the basin and national water resources management angles
Actors able to account for any health-related issues (including flooding and water contamination from poor sanitation)

The project trialled a *participatory M&E framework based on Outcome Mapping (OM)* as a mechanism for stakeholders to track project progress and flag up any corrective action that was needed. This was a suggested tool in the project proposal and an attempt was made with both stakeholder platforms to have their participation in joint monitoring of outcomes. Concurrently, the project attempted to follow changes in the knowledge, awareness, skills and attitudes (KASA) of platform members over the course of the project.

Initially, the project struggled to convey the potential value of the OM-based PM&E framework to platform members. The latter interpreted key concepts (vision, mission) in the context of strategic planning and questioned their relevance for monitoring a research-for-development project. The project team modified the approach following platform feedback. While in Ghana, thanks to in-house expertise available in applying the approach, the platform became more receptive over time, in Ethiopia it did not gain similar traction (here, project team members speculated that it was a tool that most stakeholders were unfamiliar with). An important constraint to the utility of both the OM-based PM&E framework as well as the KASA survey was turnover in platform members. While the

project worked towards securing appointed focal points within stakeholder organisations, this was only partly within its sphere of influence.

Scoring progress on a quantitative scale did pose some problems in the interpretation of results. The qualitative comments were seen to give a much more immediate and rapid assessment of what was right or wrong with the project.

Understanding processes for research uptake and policy influencing:

As was explained earlier, the complexity of the institutional context in which URAdapt works in both Ghana and Ethiopia had made the project team aware of the need for a deeper and more comprehensive understanding of the policy and institutional environment, and the governance aspects of the climate and water sectors, in addition to the processes around policy influencing and research uptake. Evidently the socio-political and cultural influences have to be understood in this regard, requiring specific types of expertise that were not always available with the project team.

The project appreciated policy as a dynamic, non-linear process. It sought to integrate itself into networks of policy actors, established relationships with consultants drafting climate related policies in the respective cities/countries, attempted to gain information about policy timeframes, priorities and contents in efforts to better tailor its messages accordingly. The process study conducted at the end of project drew out some of the following lessons. Quoting from the findings:

- The production of high-quality research is in itself insufficient for policy influence. Building ownership from the outset with stakeholders, and targeted meetings with key stakeholder constituencies who can implement recommendations, is critical.
- Policy-oriented research project should carefully tailor communication materials to the language and demands of specific audiences. If a project is able to frame its work in terms of existing agendas and policy priorities, there may be greater openness to its findings.
- Research projects that aspire to input into policy processes necessarily have limits to what they can achieve in their lifetime. While they can begin to make some inroads into policy influencing (raising awareness, for example), they are unlikely to be able to instigate a comprehensive transformation. This is a gradual process that comes about after successive projects consistently work on an issue, all the while building on previous activities. This demands a long-term vision and sustained relationships with stakeholders, as well as a strategy that is not reliant on short-term project funding.

Contribution of the donor to project success:

The role of the donor and how this involvement is translated at project management level can be critical to success. Project management and administration support from IDRC has been very good, and the project officer and his administrative assistant provided support in a timely manner. The enthusiastic involvement of the project officer and the CCAA program leader allowed for very fruitful exchanges with project staff. Project team members were actively involved in the main CCAA program activities including training, participation in write-shops and contributing to cross program publications. Project teams were also called upon to make presentations and discuss with the program's advisory board, all of which contributed to an understanding of the broader issues around climate adaptation research.

The IDRC approach of accompanying research teams from the outset, commencing with proposal refinement, to training and capacity building, to knowledge exchange, is to be commended. Access to IDRC tools and library facilities is facilitated, and the only criticism might be that at the outset, research teams may not be aware of the extent of support available.

The importance that IDRC gives to the evolutionary aspects of projects is exceptional. This reflects an understanding of the organic nature of projects and URAdapt utilised this flexibility to design its research activities better – accommodating change was a critical ingredient for success.

Similarly administrative and financial management was unobtrusive and flexible, with clear guidelines for management. This project had the benefit of using this flexibility in obtaining both a no cost extension for purposes of consolidating uptake, and to use unutilised funds for successfully concluding two additional activities, a write-shop and learning forum, which allowed the research teams to jointly focus on writing and learning from the project; and a very innovative exercise – a process study, described elsewhere.

CHAPTER 5 – PROJECT OUTPUTS

The project outputs are listed in the format provided by IDRC – list of project outputs.

Research:

Research reports: A set of 17 research reports covering the thematic areas and research topics as outlined in Tables 1, 2 and 3 under project activities were produced. The reports provided the basis for the findings which were subsequently consolidated into the strategic objectives and recommendations in the Strategic Agendas (see section on policy and practice below).

One of the main constraints faced was the lack of good secondary data and the need to generate primary data under sometimes difficult conditions. The modelling activities (climate downscaling, hydrological modelling), and water supply demand analysis were thus constrained to some degree. Many of the studies relied on primary data collection, and in particular the health impact assessment study in flood prone areas stands as a new area of research. This study required further cycles of data collection, sampling and analysis to substantiate the preliminary findings.

Dissertations: 8 MSc and 1 PhD dissertation were produced during the lifetime of the project. The research topics were defined to fit into the overall analytical research framework of the project.

Journal publications: 9 journal articles in final draft stage have been prepared for submission to peer reviewed journals based on the findings presented in the research reports and theses. 2 more potential articles have been earmarked.

Policy and practice:

Strategic Agenda for Adaptation: The main output envisaged by the project as per its objectives was to provide key strategic directions to make urban water systems more resilient to the impacts of climate change. This has been achieved through the participatory development of two City Strategic Agendas for Adaptation to Urban Water Mediated Impacts of Climate Change in Accra, Ghana and Addis Ababa, Ethiopia. Please see the relevant section in Chapter 3 for more details.

The Research to Strategic Action Platforms (Re-SAP), described elsewhere in this report, and the Consultative Group, can be seen as structures set up associated with processes undertaken to have policy influence. These platforms were not intended as permanent structures nor were they set up as such, but they were fully functional during the lifetime of the project. Whether the project should have targeted a more permanent structure is debatable. This platform was essentially a project related platform and not one set up as an institutional entity. Nevertheless, the subsequent process study results showed that stakeholders self-reported having forged new contacts (which in Ghana at least were leading to new projects.

Please also see previous section on Project Implementation and Management under Chapter 4, which details the processes and the involvement of beneficiaries and users.

Research uptake and exit strategy for Addis Ababa: A series of targeted meetings with key boundary partners, the Addis Ababa municipality, the regional authorities and the water utility and the Ministry for Water and Energy, resulted in the latter requesting a research uptake and exit strategy from the project team. This was prepared and submitted to the Ministry.

Process study**:** Clearly the process study that was undertaken by the project during its lifetime is an unexpected achievement as it allowed for a deeper understanding of the research and uptake

processes from the perspective of both the research teams and the involved stakeholders. In particular the historical narrative of project evolution, identified in qualitative terms, the emerging contributions URAdapt has made towards climate change preparedness, and the features in its operational design and strategy that allowed URAdapt to make such contributions. Though the study was not part of the original design, one might recommend that this be made standard practice of projects. Its implementation was possible thanks to balance unutilised funds available during the last 6 months of the project. The study and its findings have been presented in greater detail in Chapter 6.

Capacities:

Capacity building: project partners and stakeholders self-reported having gained technical knowledge that they plan to employ or have already employed in on-going research or the development of future proposals. Project partners self-reported having acquired skills in interfacing with policy-makers.

The project also built research capacities of students of the MSc program of the civil Engineering Department of the Addis Ababa University. 8 students were directly supervised by the research team members. Additionally two training sessions were organised in the use of modelling techniques for hydrological and climate modelling, water balance modelling and to enhance their knowledge on climate impacts on urban water systems (see Training reports in outputs list).

The project however was not designed as a traditional capacity building exercise with training programs.

Knowledge creation: New knowledge was created in the area of climate downscaling, climate impacts on water availability and demand, impacts of climate and non-climatic drivers on city hydrology, urban water storage in cities, impact of climate change on the water supply-demand gap, urban flood risk and vulnerability, health risk assessment in flood prone communities, and the urban rural dynamics that influence supply and availability of urban water.

Furthermore a clearer understanding of the policy and institutional environment influencing urban climate adaptation with specific reference to water has been gained, and the respective roles of local, regional and national governments understood in order to suggest adaptation recommendations.

Finally a better understanding of stakeholder involvement processes research to uptake processes and how projects evolve over time through being shaped by different influences has been achieved.

These findings have been documented in the process study report (see list of project outputs and Chapter 6 for more details).

Links to Project Outputs:	Reports Thesis Papers Strategic Agenda Others

CHAPTER 6 – PROJECT OUTCOMES

In the 2nd Interim report, 3 simplified outcomes were mentioned, as per the outcome mapping activity in the proposal.

Outcome 1: Based on all the knowledge inputs that the project is providing to platform members, platform partners are becoming better able to understand and evaluate vulnerability to climate change, especially in relation to the urban water cycle.

Outcome 2: Active exchange and learning between researchers, vulnerable groups and policy advisors.

Outcome 3: Policy making processes within the two countries are much better aware of the project intentions and types of evidence that will be generated.

It was suggested at the time of the report that these 3 intentions would be retained, whilst simultaneously targeting a more complete OM exercise with the platform. To this end an OM Intentional design was prepared and applied at a subsequent platform meeting. In an earlier section the constraints faced in its application have been elaborated. Nevertheless in one of the pilot cities (Accra) the exercise was completed.

With hindsight it appears that the progress markers defined for the outcomes of the intentional design reflected the reality of the outputs to be achieved and not necessarily the outcomes. The final report of the OM exercise (see list of project outputs) stated:

<<<< Generally it was very helpful using outcome mapping as a tool to monitor the outcome set for the project. It enabled the project team to make the necessary changes which will ensure that the set outcomes are achieved based on the quantitative ratings but also on the qualitative explanations. From the results it was very obvious that most of the expected outcomes were achieved. This was evident from the very high ratings (70 to 90%) given by members of the platform given to the progress markers under like to see. For example the ratings confirmed that (1) the platform included all relevant stakeholders and it continued to reflect the project goals and carried out self-assessment (in this case using outcome mapping); (2) that members met regularly to share experiences and review progress on the implementation of strategies identified by the platform and (3) the platform together with the project team developed scenarios linking urbanization, water resources management and climate change. However most of the progress markers from the later part of like to see and love to see were rated between low and medium which was rightly so since these are difficult to achieve. For examples it will take some time for cities to enjoy climate change resilient water-based services as envisaged by the project.>>>>

Reverting to the 3 initial outcomes, subsequent interim reports detailed the following statement of achievement on each:

- On Outcome 1: The value of the project concept and the systems analysis approach being applied to understand CC impacts on cities within the basin context is being better recognised and appreciated.
- On Outcome 2: After every Re-SAP meeting, stakeholders have verbally indicated their satisfaction on the knowledge sharing and learning that is taking place and this continues. It appears as if they look forward to the interactions and discussions on the platform, since these are also well structured and managed. The structure of the workshops which plan for one or two knowledge related/capacity building themes, contributes towards this. In particular our main partners WRI and AAU in the 2 countries have indicated appreciation of

the participatory nature of project implementation, and the great multidisciplinary learning experience that they are getting as a result of the project.

- On outcome 3: This continues to hold true. Nevertheless it is difficult to gauge the real impact on the policy actors as no policy change or modification specifically attributable to the project has been pinpointed. One can only say perhaps that the seeds have been sown, but with the growing global awareness of the need to address climate change, which is being taken up on national agendas, it is very likely that the recommendations for change as described in the strategic agendas for the two cities will be given a hearing.

Process study and appraising outcomes: Given this situation, the project leader recognised that a different exercise for understanding the potential impact and outcomes of a project such as URAdapt would be needed. Thus in its final months, the project commissioned a process study in efforts to scope the perceptions of platform members around what the project achieved and where it fell short of expectations. While not a formal end-of-project evaluation or impact assessment, this provided preliminary indications of the inroads that the project had begun to make in its lifetime.

The process study set out to (1) understand the evolution of the project in relation to the original project concept and notions, (2) obtain an initial qualitative measure of contributions, and (3) elucidate the features in its operational design that allowed for these contributions. To achieve these objectives a set of questions covering participants' interpretation of goals, interpretation of achievements and setbacks, the extent of leverage the project had, the strategies and tactics adopted and the concepts underpinning the project, was administered to project team and platform members using a semi structured interview mode, complemented by a documentary analysis.

The complete findings from the study are available in the process study report (see report in list of outputs), but a summary of the most relevant in so far as they indicate possible outcomes of the project and the lessons learned about the design elements for conducting research, building capacity and influencing policy processes, are presented here.

- There was appreciation among platform members that they had been able to accompany the research process from beginning to end. This was in contrast with several of their previous experiences of research projects. These often organised launch events and end-of-project dissemination workshops or consulted narrowly among a single group of stakeholders.
- The platforms had gained traction among most stakeholders as evidenced by their regular participation at platform meetings (despite the absence of formal membership) as well as their testimonies of capacity building and career advancement opportunities, learning experiences and new collaborations on climate change related issues that the project fostered.
- Nonetheless, the project could have done more in terms of stakeholder engagement. Some respondents felt that the platform meetings were too infrequent; others took the view that the project had been correct in convening the platforms on the basis of research progress and only when the team had significant new material to present. Overall, stakeholders expected more communication from the project in between platform meetings. This could have taken the form of a work-in-progress publication series circulated to members via email and made available on the website, or a web-mediated discussion forum. The project team, however, felt that such activities would have demanded greater resources.
- Platform members expected that the project outputs would have been produced more swiftly and that a degree of uptake would have occurred during the project lifetime. Its

absence signalled a shortcoming on the part of the project to fully communicate what was achievable, pointing to the importance of setting expectations in the initial phase of a multi-stakeholder process and revisiting these at regular intervals to account for any changes in project circumstances (including delays in research). These comments may also speak of a broader conceptual tension between open-ended research and pre-defined uses for its outputs.

- Respondents found it challenging to foresee possible project outcomes – particularly in terms of policy change – in the absence of the final strategic agendas (at the time of the process study these were still under finalisation). Some were of the view that the project need not focus solely on proposing new policy measures. The implementation of various existing policies could go a long way towards building climate change resilience, and the project findings could provide further impetus for this. There was overall agreement, however, that the timeframe along which outcomes would emerge would exceed the timeframe of the project itself.
- While most platform members agreed with the initial project concept as set out in the proposal by the team of researchers, others wanted greater say in the project design at an earlier stage. Overall, respondents agreed that platforms are useful mechanisms for allowing stakeholders to play what was described as a 'consultative' role in research processes. In the URAdapt case, they noted that the absence of formal protocol and the collegial atmosphere and open exchanges at platform meetings enhanced their interest.
- Quantitative modelling was the cornerstone of the project's research framework; this qualified the extent and type of participation that took place. Non-subject matter specialist recounted that a greater degree of scientific literacy would have allowed them to participate more meaningfully, particularly at the outset. As it were, the platforms in both cities had high numbers of water resource management professionals, several of whom called for more direct participation in research. This was particularly true of the Addis Ababa platform, which contained a slightly higher proportion of individuals with a technical background. Respondents also suggested that the project could have formed small working groups to accompany individual studies and prepare material for discussion at upcoming platform meetings.
- The underlying premise of the URAdapt platforms was that representatives of stakeholder organisations and communities were willing and able to act as levers for change on the basis of project outputs. This reflected a recognition that the project had to work through intermediaries in pursuit of its outcomes and ultimate impact. The project found, however, that such motivation and capacity is mediated by several factors, some of which may be beyond the reach of the project (for example, the knowledge management practices of an organisation or the value placed on research-derived recommendations in decision-making). This also leads one to surmise whether projects can actively incentivise stakeholders to act on behalf of the project.
- For the project team, the formalisation of the platforms, and their continuation beyond the project lifetime, was not an indicator of success; some platform members were of the opposite view. The team viewed success in terms of the platform's ability to motivate stakeholders to advance the use of project outputs even after the project comes to a close, and to foster relationships between the stakeholders in support of such forward action. There were indications that some platform members communicated between the project and their constituents (although this was difficult for the project to monitor beyond verbal

feedback), and that individual platform members interacted with each other without the active facilitation of the project. Longitudinal tracking of the evolution of stakeholder networks (as well as a characterisation of the issues around which such networks form) could provide indication of the sustainability of project outputs and tentative outcomes.

- Overall, however, the team served as a major driving force. Platform members in both cities were willing to contribute to joint reflection, but further action on their part on behalf of the project may have required specific incentive mechanisms (and in Addis Ababa, a formalisation of relationships).

The findings of the process study offer a set of issues to consider for projects that are planning to involve stakeholders in research processes through platforms. These include:

- Platform facilitation is resource intensive. Not only does this demand careful attention to communication (working through platform feedback and incorporating it into the research process, as well as preparing material for presentation in a manner that is accessible to a diverse audience), but also staff time that is dedicated to establishing and sustaining relationships with stakeholders (particularly in between platform meetings).
- Team composition will shape project evolution at different sites. In the case of URAdapt, research progressed more rapidly in Addis Ababa than in Accra. In the former, the project benefited from 'in-house' climate downscaling capacity among team members and, through the local partner organisation, a sizable pool of students who assisted in the research efforts. In contrast, the Addis Ababa team lacked the resources for dedicated stakeholder engagement. The Addis Ababa platform was smaller, met less frequently and experienced slightly higher turnover than its counterpart in Accra.
- Platform composition is the sum of a number of factors (including the socio-institutional settings of project sites, stakeholders' availability and levels of motivation to participate and project needs) and may evolve over time. The list of invitees to URAdapt platform meetings changed over the course of the project on the basis of emerging findings and advice from existing members. Where possible, the project relied on a meet-and-greet strategy to recruit stakeholders.
- Projects must play a proactive role in ensuring that they resonate beyond the immediate group of individuals, who attend platform meetings. URAdapt complemented platform gatherings with targeted meetings with key stakeholders, and networking to become part of wider communities that seek to influence policy. Particularly where a comparatively small, short-term initiative seeks to shape (national-level) policy, the latter is a strategy to maximise impact.
- While quick wins (immediate benefits that demonstrate the value of being part of platform) may serve to secure early stakeholder buy-in, these are not always available and projects must devise other strategies to secure commitment. In the estimation of the project team, the URAdapt research framework did not lend itself to producing tangible outputs in the immediate or even intermediate term. Instead, the project sought to involve stakeholders by inviting them to steer platform meetings, facilitate discussions or give presentations on their areas of expertise. These also served to shift ownership of the project process from the project team to stakeholders.
- 'Sustained demand creation' among top-level policy makers (continuous activities to raise awareness of a project and prepare the ground for promoting its outputs) may be at odds

with the instincts of researchers to complete studies and formulate actionable recommendations prior to interacting with senior policy officials.

- URAdapt arranged sessions at platform meetings on knowledge uptake and policy issues that were directly relevance to the project. It also invited other projects to share their experiences of developing strategic agendas and actions plans and advocating for their use. In this way, the project team hoped to better illustrate the concept of uptake and give initial tools to platform members to take project knowledge forward.

- Turnover is a standard element of platforms and needs to be addressed directly. A platform can maintain continuity by involving several key people from different levels of a stakeholder organisation (provided that the internal dynamics of stakeholder organisations allow for this). Networking beyond the group of primary stakeholders can also serve to offset the consequences in turnover in platform participants.

CHAPTER 7 – OVERALL ASSESSMENT AND RECOMMENDATIONS

Despite a heavy emphasis on generation of new knowledge through scientific study, the URAdapt project was very much one of process – using science for informed decision making and influencing policy. Recognising the right partnerships (both international and national) is critical to this, and in trying to achieve development oriented outcomes, the role that research organisations play in this process has to be reviewed. All too often such organisations do not go beyond the phase of knowledge generation. Thus organisations with policy and development orientations particularly with a national focus, can play a facilitating role, and should therefore be an integral part of the partnerships for project implementation. A project such as URAdapt implemented by an international research organisation, in partnership with national research entities, would have greatly benefited from the presence of national policy-oriented organisations complemented by inputs from international policy organisations whose experience and expertise would benefit such a project.

A second point of interest is to recognise the limits of project based approaches for achieving development outcomes. The project time frames are all too limited and most projects especially those with a heavy knowledge generation component (which necessarily involve research organisations and universities as the implementing agencies) do not pay sufficient heed to linking these processes with national policy processes.

IDRC with its long experience of research for development is fully aware of the limits of project-based approaches to furthering development impacts. As a Development Agency, IDRC might see the need for sustained funding on the part of donors supporting their programs with a trickle-down effect to projects for undertaking research uptake activities once the project itself is ended. This emerged as a suggestion from stakeholders on the project who in spite of engagement, place the onus of follow-up action on the shoulders of the main implementing agency (IWMI). The right mechanism for such support will have to be realised on a case by case basis.

International research bodies like IWMI may need to potentially rethink their position about sustaining long-term relationships and the forging of strategic partnerships with organisations that are better positioned to deliver development impact.

Less has been said about the role of such agencies in the arena of climate adaptation. The complexity and uncertainty of predicting climate related impacts on systems and the necessary adaptation responses, requires that methods for appraising outcomes of projects may have to be reviewed. A clearer idea of what realistic outcomes can be envisaged, clearly enunciating these and working towards achieving them is a must when dealing with adaptation to climate change.

Finally, a number of research gaps were identified for future work, and suggestions for uptake were made by stakeholders both in Accra and Addis. The Africa Climate Policy Centre also showed a keen interest in pursuing some of the findings of the project which would have relevance for adaptation policy across Africa. There is a plethora of ideas generated by this project with definite potential for a further project on urban water systems adaptation to climate change. This would be a fitting follow up to maximise the benefits of IDRC investment in a research area that is only now breaking ground in Africa.