ELLA
Evidence and lessons from Latin America

Experts from Africa, Asia and Latin America discussed infrastructural weakness in cities that are exacerbated by climate change, considered the causes for such weaknesses and possible means of overcoming these. Examples of successful programmes related to energy, housing, waste management and water management in Latin American cities were shared with Learning Alliance participants.

IMPROVING INFRASTRUCTURE FOR CLIMATE RESILIENCE IN CITIES

SUMMARY

This discussion allowed participants to analyse the infrastructural weaknesses in their cities that are becoming increasingly problematic given the changing climate. Experts from African, Asian and Latin American cities considered why infrastructure is not meeting the needs of city dwellers, and what might be done to encourage investments in infrastructure. Interviews with Latin American experts from Mexico City, Mexico, and Lima, Peru, highlighted successful strategies for improving wastewater management. Key factors to success in these cases included a good return on public spending (Mexico) and an integrated approach (Peru). Participants from Africa and Asia also shared successful examples from their cities.

Key Conclusions

The online discussions pointed to the following conclusions regarding the challenges and opportunities of improving infrastructure for climate resilience in urban environments:

- Urban infrastructure in cities across Africa, Asia and Latin America was poorly planned, is unable to meet the needs of growing urban populations, and is vulnerable to the impacts of climate change
- On the whole, urban infrastructure is not properly maintained and a lack of public awareness often exacerbates existing weaknesses
- In order to upgrade infrastructure to meet the needs of growing populations facing increasing climate risks, there is a need for integrated city development plans involving multiple-stakeholders
- Significant financial commitments need to be made to improving the climate resilience of existing infrastructure

CONTENT

Discussion: Improving Infrastructure for Climate Resilience in Cities

Learning Focus

The discussion considered how the weaknesses of existing infrastructure affect urban climate vulnerability and risk in cities across Africa, Asia and Latin America. Infrastructure is fundamental for public service delivery, including access to water, sanitation, electricity, communication and transportation, amongst others. When infrastructure ceases to function, and these services become unavailable, the livelihoods and wellbeing of city inhabitants are put in jeopardy. Extreme events and the impacts of incremental changes in the climate are already producing negative effects on the provision of such services, and this week's discussion centred on the reasons behind this. Participants considered the state of infrastructure in their cities and identified weaknesses that they felt were being worsened by the changing climate. They then went on to discuss how these challenges might be overcome, including how to encourage investments in making urban infrastructure climate resilient. Two case studies from Latin American cities were shared with participants: one from Mexico City, which illustrates how investment was captured to improve wastewater treatment by highlighting the profitability of such an endeavor; and one from the city of Lima, Peru, where success was achieved by developing an integrated approach to providing water and wastewater infrastructure. Participants were encouraged to consider these cases and the enabling factors for their success, and then reflect on how lessons learned could be used to improve the climate resilience of infrastructure in their cities.

Discussion 7 was guided by the following three questions:

1. What infrastructural improvements do you think are necessary in your city in order to increase the climate resilience of vulnerable communities?
2. How is existing infrastructure being managed in the face of climate challenges?
3. How might it be possible to encourage 'no-regrets' investments in infrastructure in your city?

Latin American Case Studies

Due to the enormity of this theme, the Latin American experiences presented focused on water and wastewater management. Participants, however, were encouraged to discuss all types of infrastructure that they felt was being affected by the changing climate, and which could be improved to increase climate resilience. In order to provide direct insight into the Latin American case studies, interviews were carried out with Fernando Rodrígez from Bajo Carbono, Mexico, who described how low-carbon wastewater treatment programmes turned a profit for local authorities, and Rossana Poblet from Lima, Peru, who described the distinct climate change and water stresses affecting the capital city of Lima, as well as the concerted efforts taken to address these challenges by using an integrated approach to water and wastewater infrastructural management. Both of these interviews are provided in full at the end of this document.

Discussion Participation

Ten countries were represented in this discussion, with contributions from 30 participants in total. South Asia and Sub-Saharan Africa were the most represented regions.

Summary

According to those that participated in this discussion, on the whole, cities across Africa and Asia have taken limited action in terms of making urban infrastructure climate resilient. There was significant discussion around which types of infrastructure were being affected by incremental changes in the climate and by extreme climatic events, as well as the reasons for current infrastructural weaknesses. Aside from sharing some positive experiences from certain local initiatives, participants shared ideas on what might be done to encourage investment in infrastructure.

Types of infrastructure that were cited as requiring significant investment and upgrading included: electricity access and public lighting; housing and other buildings; roads and transportation; sanitation, waste disposal and drainage systems; and water supply, treatment and storage.

> *"Ho Chi Minh City has many problems of traffic, pollution, flooding, overloaded infrastructure, lack of green and public spaces...bad planning has created great vulnerability to climate change."*
>
> *- Thuy Duong Pham, Vietnam Donor Organisation*

In terms of specific weaknesses that are exacerbated by climate change, participants gave examples of how infrastructure is being affected by increasing heavy rains and periods of intense heat. Furthermore, the discussion suggested that increasing urbanisation was in part due to changing weather patterns with populations having moved to the cities in order to find new means of making a living. As a result, demand for public services such as water, sanitation and electricity now exceeds the capacity of existing urban infrastructure. Aside from population growth, participants explained that in many cases populations have rapidly settled in urban areas in a disorganised manner, making the installation of infrastructure challenging and also putting this infrastructure at high risk (i.e. by settling in flood prone areas).

When analysing the reasons for infrastructural weaknesses, an overriding message from participants was that infrastructure across these regions was poorly planned.

> *"Basic services like water supply, sanitation, solid waste management and transport are the primary services which face huge demand from the rising population in urban centres, yet are either poorly planned and developed or are insufficient to cater to the present demand. Climate risks not only pose a threat to the service efficiency but also pose risk to the assets that carry these services for example, water supply lines, storm water sewers, etc."*
>
> *- Divya Sharma, India Research Institute*

City dwellers find themselves served by infrastructure that has been in place for decades, or even centuries, and which was not designed to meet the needs of today. Urban populations nowadays are much larger than they were during the original construction of roads, train lines, electricity and water distribution networks and drainage systems, to name but a few.

> *"In Ghana we have infrastructure that dates back to the colonial era, with well over one hundred years of life... authorities pride themselves on such heritage, with no attempts being made to give a new look in order to withstand the test of time."*
>
> *- Joseph Senyo Kwashie, Ghana Civil Society*

Other causes that were cited for the inadequacy of existing infrastructure included a lack of maintenance and low public awareness. Participants from Bangladesh, Ghana, India, Zambia and Zimbabwe all spoke of these weaknesses, providing examples of flooding resulting from blocked drains, roads becoming dangerous, and ineffective waste management creating health problems. Many participants commented on the lack of public awareness about how certain infrastructure operates, and that at times it is the local inhabitants or public sector employees themselves who exacerbate existing weaknesses.

> *"In some cases municipal street sweepers often sweep soil and waste into storm water catch pits to dispose of waste"*
>
> *- Riaz Jogiat, South Africa Government*

Participants also stated that new infrastructure often does not take environmental considerations into account, but rather that authorities plan for the short and medium term, aiming primarily to fulfil the present needs of the population, without thinking about long-term sustainability. Key barriers to the development of new infrastructure were felt by participants to be weak planning and a lack of funds. Poor coordination between stakeholders was also identified as a major setback, as was the fact that climate change and sustainability are not generally integrated into infrastructure design. Thus, new infrastructure quickly becomes out-dated and inefficient.

The lack of finance was generally attributed to local authorities not prioritising infrastructural upgrading or maintenance. What is more, although significant amounts of resources are allocated to infrastructure in many developing cities, much of this ends up being embezzled.

> *"In a country with high levels of corruption...some state vendors, reduce costs or divert funds, thereby resulting in the use of less resistant, or poor quality materials"*
>
> *- Alejandro Flores Lozano, Peru Independent Consultant*

When thinking about how to encourage 'no-regrets' investments in infrastructure, participants suggested the following strategies:

- Improving awareness among leaders and the general population
- Lobbying decision makers to show that prevention is more efficient than response, which can be achieved by sharing successful case stories from other cities
- Mobilising political support for integrating climate change considerations into city development plans
- Developing integrated city development plans
- Developing non-partisan multi-stakeholder groups to work on plans and actions

Some examples of positive steps being taken in cities across Africa and Asia in terms of improving the climate resilience of urban infrastructure included:

1. Green Buildings

   In Ghana, the Green Building Council has been working with local partners to improve the sustainability of buildings. In the city of Bhuj in India buildings became more resilient to earthquakes once they were retrofitted. Latin American cities have also made significant developments in the field of Green Buildings, more information on which can be found in ELLA Brief: Green Building in Latin America.

2. Energy Generation and Supply

   Participants from Ghana shared information about a project known as Sustainable Energy for All (SE4ALL).

> *"The plan seeks to show the impacts of low-carbon development options, beyond the usual mitigation focus of price per tonne emissions avoided. This goes a long way to improve climate resilience of vulnerable communities, since the, plan looks at clean coal, clean cook stoves, expanding hydro power etc."*
>
> *- William Kofi Horsu, Ghana*
> *Non-governmental Organisation*

   Many initiatives have also been implemented in Latin America to encourage the use of renewable energy sources. For more information on these examples, see ELLA Brief: Incentives for Electricity Generation in a Green Economy: Effective Frameworks from Latin America.

3. Waste Management

   An excellent example of a city investing in improving waste management came from the Cities Development Initiative for Asia (CDIA), which assisted the city of Chennai (India) with a pre-feasibility study for improving waterways and solid waste management. Chennai Corporation took these projects on and some actions have been taken to improve drainage and waste management.

4. Water Access and Treatment

   Aside from the two cases shared from Mexico and Peru, we heard that in Accra, Ghana, a new water treatment plant has been developed, and in Harare, Zimbabwe actions have been taken to replace piping in water distribution systems.

Key Lessons:

- A major problem with urban infrastructure in cities across Africa, Asia and Latin America, is that current demand exceeds capacity; infrastructure has not been improved to cater for urban growth, and neither is infrastructure properly managed and maintained in order to avoid bottlenecks.
- Increasing awareness about how certain public services are delivered might reduce additional stress induced by city dwellers, such as waste and water management
- Climate change impacts should be taken into account when designing and planning infrastructure upgrades or expansion in order to avoid short-termism and improve climate resilience
- The involvement of multi-stakeholder groups can increase the effectiveness of investments in infrastructure, to ensure that resources are split between hardware and software such as maintenance capacity and awareness raising.
- In order to secure the significant investments required to improve the resilience urban infrastructure, local and national governments need to be committed to the concept of addressing climate challenges

Supplementary Materials

Participants were provided with the following resources in preparation for the discussion:

- Paving the Way for Climate Resilient Infrastructure (UNDP)
- UCCRN: Climate Change, Water, and Wastewater in Cities
- UN Habitat: Climate's Long-term Impacts on Mexico's City Urban Infrastructure
- Municipalities Adapting to Climate Change: Reducing Urban Vulnerability Through Infrastructure
- World Bank News Article: Latin America Leads in Water Management but Inequalities in Access Remain
- Adapting Urban Water Systems to Climate Change: A Handbook for Local Decision Makers
- Lima, Peru: Reuse of Treated Wastewater for Urban Greening and Agriculture
- UN Habitat: Climate's Long-term Impacts on Mexico's City Urban Infrastructure

BEST PRACTICES IN THE USE OF WASTE WATER TREATMENT TECHNOLOGIES IN LATIN AMERICAN CITIES

Interview with
Fernando Rodríguez

Fernando Rodríguez *joined the Mexican company Bajo en Carbono ('Low Carbon') in 2009 as an Executive Partner specialising in carbon markets and responsible for developing energy efficient projects. Currently, Fernando also provides consulting services to Det Norske Veritas and TÜV-Rheinland, in particular financial analysis of several Clean Development Mechanism (CDM) projects in Latin America.*

In what ways are water facilities, water structures, water supply sources and wastewater disposal mechanisms in Latin American cities affected by climate variability and climate change?

Water sources and infrastructure are affected by climate variability in the following ways:

- A common practice in Mexican cities, as well as most cities around the world, is that rain is collected through the same network as sewage coming from the homes of local citizens. Therefore, water infrastructure in urban dwellings must take into account not only expectations of population growth, but also it must consider the effects of climate change and the growing unpredictability of precipitation.
- Climate change has a negative effect on existing infrastructure. Variability in precipitation will cause pumping equipment to work below its optimal operating window, creating higher energy consumption and equipment wear.
- Modelling for precipitation has become more difficult, this complicates planning and development of future infrastructure projects, as well as allocating funds for investment.
- Climate change and variability will also reduce water supply for the agricultural sector. Fortunately, treated water contains nutrients that are beneficial for crops. Hence, steps must be taken to foster demand in the agricultural sector for treated water that comes from urban dwellings.

What instigated the development of research projects on best practices in wastewater treatment technology used in Latin American towns and cities?

Bajo en Carbono developed two research projects. The first project focused on best practices for small-scale wastewater treatment plants. The second project evaluated the true cost structure and feasibility of several measures that make the McKinsey greenhouse gas abatement cost curves.

We were interested in conducting analysis of technologies in use in order to provide guidance for future development in the region. These technologies were judged mainly in terms of emissions reductions and financial implications. We made some very interesting discoveries related to power generation from biogas produced during wastewater treatment.

From an urban climate change adaptation and mitigation standpoint, what were the key findings from this study? What are the best practices in waste water treatment in Latin American towns and cities? What are the strengths of these particular technologies, in terms of urban climate change adaptation and mitigation?

The study produced four main findings:

1. The main finding was that for waste water treatment plants, scale drives profitability. Of all the technologies evaluated, activated sludge generated the most biogas and was the least expensive to use. Therefore, a large flow waste water treatment plant that uses activated sludge is the best option since it is cost effective and can produce biogas to cover part of the plant's energy demand, reducing its operating cost.

2. Waste water treatment plants in Latin America tend to be state-funded. Our analysis showed that in fact these plants do not necessarily require government funding because such projects can turn a profit.

3. Sludge contained in an anaerobic environment produces biogas that can power a generator. The electricity generated can cover more than 30% of the plant's demand, effectively reducing GHG emissions.

4. Waste water treatment plants have various benefits, such as improving health indicators in the local population and reducing demand for potable water by reusing water for industrial activities.

What challenges must cities overcome in order to implement the use of waste water technologies? What would enable more cities to utilise these technologies?

The main challenges in Mexico are related to local administration. Municipalities are ill prepared to manage the operation of a waste water treatment plant, and are even weaker when it comes to investing in long-term infrastructure projects. Overall efficiency in Mexican water utilities averages 40%, including the network' operating conditions, billing and treatment. There are no guidelines or best practices established in order to estimate a tariff, which is not set by the market either. Operators and municipalities set up a tariff arbitrarily, and then look for federal funding to cover their losses. Municipal administrations last three years, but the average turnover for a person in charge of the local water utility is 1.5 years. This makes it difficult for the people in charge to gain enough experience and there is no sense of accountability.

We must work with local municipalities and assist them with their urban development plans, selecting projects that are cost-effective, that have a high impact on sustainability, and free-up resources for more pressing projects. We must also work with local authorities to look for sources of financing from the private sector, and to broaden their approach from a reactive, short-term response, towards actions that are more strategic and sustainable with a long-term outlook.

WATER AND WASTEWATER MANAGEMENT IN THE CONTEXT OF CLIMATE CHANGE: EXPERIENCES FROM LIMA, PERU

Interview with
Rossana Poblet

Rossana Poblet *has worked as a Senior Technical Officer for the Ministry of Housing, Construction and Sanitation in Peru and is currently employed as a Senior Research Officer for the Institute of Planning and Ecology (ILPOE) in the Faculty of Architecture and Urbanism at the University of Stuttgart, Germany.*

Why is the integration of water and waste water infrastructure management into municipal planning strategies and planning tools important in the context of climate change?

In a fast growing city such as Lima, Peru, one of the most crucial aspects in the urban water cycle is the man-made infrastructure built to provide potable water. This infrastructure has many different stages including catchment, treatment, distribution, use and derivation to open water bodies in order to supplement the water cycle. As a result of inefficient water and waste water management on the part of the city, this process has diverse negative impacts on the environment as it fails to consider hydrological cycles and ecological processes. In light of these challenges, the project "Integrated Urban Planning Strategies and Planning tools" developed the WP9 project "Sustainable Water and Wastewater Management in Urban Growth Centres Coping with Climate Change - Concepts for Lima Metropolitan (Peru) - (LiWa)," which aims to define sustainable and integrated urban planning strategies and planning tools, with a specific focus on integrating water and wastewater management into the open space planning system. In doing this, what is established is a multifunctional open space system that is strong enough to guide the urban development process, and at same time, promote savings in potable water and the reuse of wastewater as a means of closing the urban water cycle in Lima.

What led the city of Lima to consider an integrated approach to water and waste water infrastructure management?

In Lima, approximately 70% of the city has grown in an informal way. Thus water service provision has become a means of consolidating settlements and private ownership in different areas depending on such factors as topography and risk, and whether the area is protected, public space or productive land. As a result, there is no balance between residential areas and water and waste water infrastructure meant to support settlements for further development. A main outcome of these processes is a fragmented city that lacks adequate water and waste water services, including open spaces and green areas.

Although the municipal government is responsible for managing the urban planning process, the public administration is characterised by weak implementation and enforcement due to economic priorities. In contrast, the national water utility company, Sedapal, adopts a practical approach to providing potable water in Lima, as well as its consolidation of occupation spurred by massive urban sprawl. The municipal government of Lima is now seeking to incorporate water and waste water into its management functions, however this entails a long bureaucratic process. In spite of this, different initiatives to exchange data and work closely with the Metropolitan Planning Institute (Instituto Metropolitano de Planificación – IMP) and Sedapal have been implemented in order to make positive steps in the direction the integrating water and waste water infrastructural management in Lima.

What steps have been taken in order to integrate water and waste water infrastructurae management into Lima's municipal planning strategies and planning tools?

The WP9 project developed the Lima Ecological Infrastructure Strategy (LEIS) based on the concepts of 'green infrastructure' and 'water sensitive urban design' that were adapted to the dry climate of the city. This strategy includes planning, assessment and design tools that were developed to assist water management and urban planning. In addition, a landscape and urban planning framework has been developed for the lower Chillon River watershed in the North of Lima. This framework includes a design proposal for flood protection of the river park in the area of Chuquitanta, San Martin de Porres, Lima, and provides an innovative example of ecological infrastructure. These technical proposals are part of long-term, on-going processes of adaptation and adoption of climate change measures in the city. We understand that bureaucratic challenges make the effective integration of water and waste water infrastructure management in Lima's municipal planning strategies and planning tools a time consuming process.

What challenges have been encountered in efforts to integrate water and waste water infrastructure management into lima's municipal planning strategies and planning tools?

- Within the municipal government there is limited political will, as well as poor coordination and agreement between different levels of government;
- Despite Lima being the first megacity to face water stress, the city's development plan lacks adequate consideration of water issues;
- There has not been an update of urban planning instruments in the city. The last urban development plan in Lima ended in 2010 and was subsequently extended for a year. Currently, the 2012-2015 Regional Plan is in motion but there is no set date to start the Lima Metropolitan Urban Development Plan, an urban planning instrument meant to guide future urban development in Lima;
- The city authority maintains a narrow approach to development projects, with existing initiatives suffering from weak collaboration between planners, designers and water experts;
- The municipal government only has a small budget for investing in ecological infrastructure;
- Weak governance and internal conflicts are endemic at different levels of water and waste water infrastructure management in the city

What have been the key results of efforts in Lima to integrate water and waste water infrastructure management into planning strategies and planning tools?

The key results of the project to date include the definition of main planning principles needed in order to integrated planning with other relevant areas of policy and practice. Over the past few months, workshops have been conducted with different stakeholders as an input into the Regional Joint Development Plan 2012-2025 in Lima (PRDC), using some of the objectives, programs, projects and actions problematized within these workshops.

The PRDC focuses on five key dimensions: environment, urban, social, economic and governance. The Regional Plan identifies approximately 30 development processes currently happening in the city related to water and waste water infrastructure management, seven of these processes are related to urban-environmental topics and four processes are connected with LEIS (ecosystems, vulnerability, water, governance).

- The principle strategies identified to respond to these development challenges include:
- Protect, develop and implement a water sensitive and multifunctional open space system considering availability and integral management of water resources
- Protect and consolidate agricultural land and add value to improve ecosystem performance
- Transform high risk areas with ecological infrastructure

- Promote water sensitive urban development that considers water catchment, saving, treatment and reuse within the city
- Integrate principles of water sensitive urban development into city management using a sustainable and resilient approach

A further achievement is the inclusion of a sustainable development programme for the Lower Chillon River watershed in the PRDC.

What are the distinct strengths of Lima's integrated approach to water and waste water infrastructure management, in the context of climate change?

The strengths of Lima's integrated approach include:

- The promotion of natural and man-made ecosystems as part of a multifunctional water management system that can give coherence to the city (i.e. make the provision the same for all in the city), reduce physical and social fragmentation and guide the urban development process, while at same time contributing to sustaining the urban water cycle through reusing treated waste water and increasing the amount of green areas and environmental services in a sustainable way
- Efficient use of water and waste water to sustain the urban water cycle
- Promotion of the reuse of waste water and other urban waters in the city, resulting in savings in potable water
- The strength of the ecological structure of the city, in terms of it becoming a multifunctional management system

For more information on Sustainable Water and Wastewater Management Strategies and Planning with Climate Change Concepts in Lima, Peru, consult the following PowerPoint presentation:

http://resilient-cities.iclei.org/fileadmin/sites/resilient-cities/files/Resilient_Cities_2012/Program_Updates/Presentation/G/G1/LiWa_WP9_ILPOE_Workshop_15052012_rp_final_presentation.pdf

CONTACT SSN

To learn more about the Learning Alliance on Climate Resilient Cities, or any of the specific themes raised in the Learning Alliance Highlights, contact the author and Learning Alliance moderator, Charlotte Olivia Heffer, ELLA Brazil Project Coordinator at the Environmental Laboratory at the Federal University of Rio de Janeiro (UFRJ), at charlotte@lima.coppe.ufrj.br.

FIND OUT MORE FROM ELLA

To learn more about climate change, disaster risk management and governance in Latin America's cities, visit the ELLA website, which has a full list of the knowledge materials available on these topics. To learn more about other development issues, browse other ELLA Themes.

ELLA is supported by:

SOUTH SOUTH NORTH

UKaid from the British people

PRACTICAL ACTION Consulting