

Dar es Salaam, Tanzania

Demonstrating the Urban NEXUS approach to link water, energy and food resources in schools

Through cross-institutional collaboration, two schools in Dar es Salaam operationalized the Urban NEXUS approach as a new design process towards resource-efficient and productive service delivery. The project serves as an example of integrated solutions for optimizing energy, water and food to be scaled up throughout the metropolitan region.

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Urban NEXUS Case Study

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Abstract

By generating cross-institutional collaboration for infrastructure systems and services at schools in the Kinondoni District, Dar es Salaam, the Urban NEXUS pilot project harnessed opportunities to link water and sanitation, energy, food and waste, solutions which would have otherwise been missed with a singular development application. By piloting the approach in two adjacent primary schools, and applying the lessons learned to policy, regulation and practice to upscale across all schools (and other public spaces, clinics, municipal buildings etc.) in the city over time, a substantial impact on planning and service delivery in Dar es Salaam can be achieved.



The importance of integrated solutions in Dar es Salaam

Dar es Salaam, not unlike other rapidly developing metropolitan regions, contains a complex set of ecological, social, economic, political, administrative and institutional systems. The metropolitan region faces a multitude of risks and vulnerabilities: 1) scarcity of access to resources – particularly energy and water; 2) a back-log of municipal services (e.g. transport, water, drainage and waste management); 3) burgeoning informal sector, high poverty and unemployment rates, in turn linked to malnutrition and health challenges; and 4) an on-going need to create social and economic development, which simultaneously also provides opportunities that must be harnessed (e.g. a young entrepreneurial population).

In the face of a changing climate. New Urban NEXUS models of planning, implementation and design are required in order to reduce these risks, and to create a future productive and resilient city that can maintain its high contribution to local and national economic development.

Date	2011-present
Urban NEXUS Sectors	Water-Food-Energy-Education
Urban NEXUS Innovations	Institutions, Design and Technology, Communication and User Behaviors, Service Delivery Models
Scale	Facility (two schools), Kinondoni District
Budget	€57,430

Urban NEXUS Definition

The Urban NEXUS is an approach to the design of sustainable urban development solutions. The approach guides stakeholders to identify and pursue possible synergies between sectors, jurisdictions, and technical domains, so as to increase institutional performance, optimize resource management, and service quality.

It counters traditional sectoral thinking, trade-offs, and divided responsibilities that often result in poorly coordinated investments, increased costs, and underutilized infrastructures and facilities. The ultimate goal of the Urban NEXUS approach is to accelerate access to services, and to increase service quality and the quality of life within our planetary boundaries.

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Kinondoni, Dar es Salaam, in context

In Dar es Salaam, the decentralization process of developments to create integrated plans, master plans and projects such as the Sustainable Dar es Salaam Project (SDP), have all made excellent strides in advancing city planning. Additionally, they indicate a need and urgency of innovative planning that is fully integrated. Despite such developments, Dar es Salaam's urban institutions, services and management approaches remain largely fragmented, resulting in a loss of opportunities and challenging trade-offs such as the loss of rivers, wetlands and ecosystem services that reduce flooding in the rainy season, as communities have built informal homes, structures and settlements in these spaces the lack of waste management that further results in waste accumulation in drainage systems and remaining rivers.

- Currently, communities are reliant on water from standpipes and private vendors, whilst only 8% of houses have a direct water connection, which is often only available for nine hours a day (Atkinson, 2013).
- Many parts of the city lack sufficient water for drinking, including schools.
- One third of the national population is undernourished.
- Energy supply from largely hydro-electric sources is intermittent and utilized by few, with the majority using wood fuel (charcoal and firewood) as a primary energy supply for cooking and heating.
- The cost of wood fuel is increasing, as the supply diminishes as a result of deforestation around the city.
- Sanitation and waste is a major challenge in the city and is not considered to be a resource.

All of these sectors are regulated, serviced, developed and administered via separate silos. As a result, typical development projects even run by large finance institutions, banks and multilateral organizations apply development finance in singular sectoral developments that do not take into account the opportunities for resource efficiency through integrated approaches.

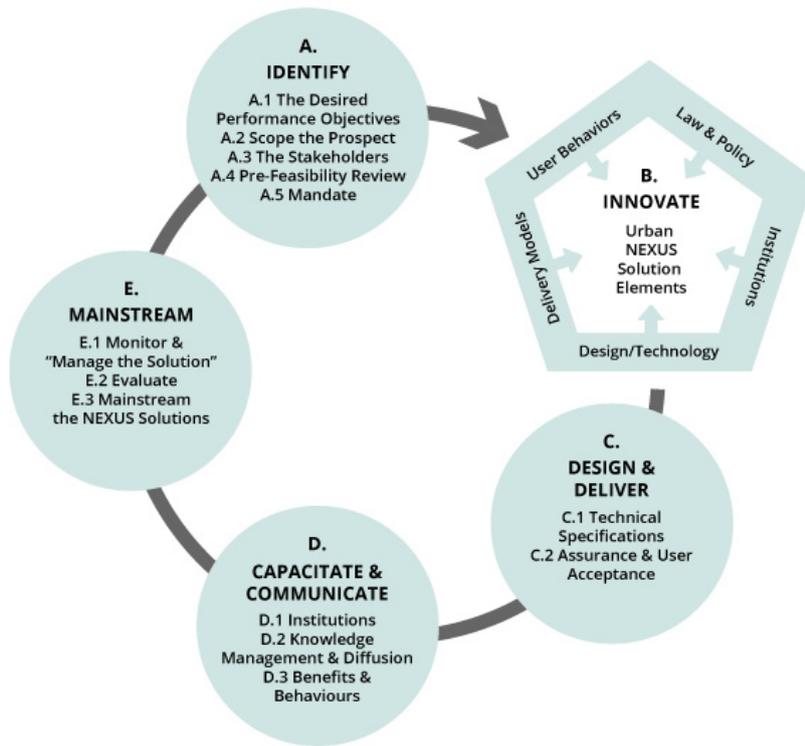
Utilizing the Urban NEXUS Development Cycle to realize integrated solutions in Kinondoni schools

Identifying Urban NEXUS Performance Objectives in Dar es Salaam

This project aimed to showcase a multi-departmental Urban NEXUS Development Cycle approach (see page 3) for the planning and implementation of school infrastructure and services to highlight efficiencies and cost savings. As a result, the project aims to showcase the opportunities and spin-offs created through an Urban NEXUS approach to link water, energy, urban agriculture and nutrition with waste, health and education for enhanced productivity and quality of life.



Municipality workshop with local stakeholders



The Urban NEXUS Development Cycle (GIZ and ICLEI, 2014)

The Urban NEXUS Development Cycle is a process for translating integrated planning objectives into Urban NEXUS policies, projects, systems, and places. The implementation of the present pilot project in Dar es Salaam focused on the first three steps, reaching the phase of Design and Deliver.

Identifying and Scoping Urban NEXUS prospects for integrated action at the Tandale Elimu and Hekima schools

Schools in compact, high density, and low income communities in Dar es Salaam often serve multiple functions as community gathering areas. These include acting as football fields or meeting points, as well as the potential to serve as disaster management meeting and relief areas when situated on high ground during localized flooding - a widespread challenge throughout the city. School-goers in these communities often suffer from malnutrition which affects childhood development and school performance. School feeding programs provide an opportunity for innovation and re-integration to strengthen links to community beneficitation through increasing decentralized self-reliance connected to local services (e.g. food gardens). Schools are also ideal community hubs and spaces that can act as community education facilities for children and adults alike, by showcasing methodologies for increased resilience that can be replicated in homes, while boosting local economic development.

Kinondoni's pioneering Urban NEXUS stakeholders

The project addresses Kinondoni's challenges of improving i) the school environment; ii) the school feeding program and iii) reliable access to water and energy efficiency. ICLEI - Local Governments for Sustainability, supported by the German Development Cooperation, managed the project and introduced the Urban NEXUS approach to a wide range of stakeholders.

As schools are administered under local governments in Tanzania, the project

Institutional administrative set-up in Dar es Salaam

The Local Government Act of 1982 served as the main guideline for urban authorities. Sustainable Dar es Salaam project was constructed in response to the 1990 master plan review as a framework for sustainable development in the city, providing opportunities for cross-sectorial work.

Dar es Salaam was decentralized in 2000, which established the Dar es Salaam City Council as a coordinating body for the three municipalities in the metropolitan region. It was mandated to cater to cross-municipality concerns, more specifically defined in Act No. 6 of 1999 s. 56. Planning guidelines are provided by the central government to the municipality and the district council. Funding on the other hand comes from both central government and district budget. The smallest entities in a city are the "Mtatt" which are similar to a ward.



Rainwater tank and vegetable gardens.

Urban NEXUS Partners in Kinondoni

The project was implemented in partnership with Engineer Mussa Natty, Municipal Director of Kinondoni Municipal Council, as well two of KMC staff members Mr Yohana Mgonja and the late Mr. Israel Mabiki. EEPKO was headed by the Project Manager, Mr Alfred Shayo.

Breaking the 'silos' in thinking and action

“Silo -thinking” refers to the mind-set and practice where an organization such as a municipality or a company is organized and works around the concept of individual functions, departments or sectors.

Entire resource systems often represent such “silos”, right from the natural resource base (e.g. ground water) to their separate facilities (municipal pumping facilities, distribution for irrigation), utilities (regional water company), and institutions (regional water protection board) that manage them, right up to separate national ministries that deal with them (e.g. the Ministry of Water Resources for ground water, or Ministry of Environment for wastewater and sewage).

Although sometimes very efficient within their own structures, the efficiency of overall operations is reduced by such fragmentation as information is not shared, co-benefits from collaboration and integrated actions are lost, and the cumulative benefits from combining budgets are not realized. “Silo cultures” encourage institutional introversion, competition or reduced morale to the detriment of a productive collective culture.

GIZ and ICLEI, 2014, Operationalizing the Urban NEXUS, GIZ Study

received tremendous support from the Kinondoni Municipal Council (KMC), the key implementing partner of the project, particularly from the directive of the Municipal Director. Aside from financial commitment, human resource capacity was allocated through the involvement of technical officers. The local implementing partner was the Environmental Engineering and Pollution Control Organisation (EPCO), who worked closely with the municipality and community.

Accelerating Urban NEXUS action through community workshops

The Kinondoni Municipality (KMC) brought together a vast array of stakeholders via a community workshop to discuss Urban NEXUS opportunities and interventions. Participants included stakeholders who could serve as focal points to the wider community in partaking and mainstreaming the Urban NEXUS approach. Community members were represented by the school headmasters, faculty, Mtaa (see text box page 2) and religious leaders. Private sector organizations, university professors and NGOs also participated in workshops and project design.

Rather than bringing in a pre-conceived idea of what to implement, the project followed a process to facilitate the decision-making between numerous stakeholders. Initially, group discussions took place to brainstorm ideas for water, food, energy, sanitation, and ecologically oriented solutions. This helped to create broader visions for the schools. ICLEI and EPCO then presented feasible options and ideas which could be implemented within the project budget. Following, stakeholders had the opportunity to vote for the solutions they most wanted. The decision was based on a majority vote in favor of solutions that could be implemented at both schools, rather than just one.

This kind of open, collaborative design process is new in Dar es Salaam, so much so, that it was the first time that a full stakeholder meeting was held at the KMC offices to discuss the financing and implementation of a development project. A series of questions related to the project and its ability to be up-scaled with similar initiatives were asked at the municipal workshops using a SOAR (Strengths, Opportunities, Aspirations, and Results) approach. This processes meant to facilitate changes in decision-making behavior and spending.

The school and municipality essentially defined the problems and solutions with assistance from the ICLEI and EPCO teams. Ultimately, the project focused on improving i) the school environment; ii) the school feeding program and iii) reliable access to water and energy. All of these link either to current attempts to attain improvement in these areas, or to future plans. However, before the application of the Urban NEXUS methodology these were typically approached on a one-by-one basis with no spatial or temporal synergies across sectors, and little discussion of how to implement them all synergistically to reduce costs. The process of including stakeholders in the actual decisions of what the funding would be spent on was very new, as was the method of open discussion.

Pre-feasibility review

Ultimately, the vision for the school developed through the community workshop included a range of highly innovative and technologically intensive interventions that could not be implemented within the scope of this project. However, the ideas nonetheless guided the actual process of how to allocate the resources available in

the current funding tranche.

Major challenges to the project, such as the limited budget and timeframe, were identified, which did not suit the ultimate objectives of implementing a full Urban NEXUS approach. This, however, was seen as an opportunity rather than a constraint and regarded as a real world challenge that would push innovation, collaboration and efficiencies. Additional challenges ranged from: i) the lack of a secure perimeter wall; ii) different utilization of the space between day and night/week-time and weekend/term-time and school holidays; iii) lack of technologies available for purchase in Dar es Salaam; etc.

The final decisions on project spending resulted in the utilization of relatively common technologies but in an integrated manner designed to respond to multiple development challenges. Thus, an interlinked system composed of vertical food gardens, energy efficient technology, rainwater harvesting and waste reuse was sought to be implemented. The intervention aims to repurpose rainwater for urban agriculture that can provide nutritious food for the students, while minimizing flooding impacts and energy consumption. The establishment of vertical gardens also serves to showcase agricultural opportunities in densely populated areas.

Results

The project, whilst following the newly developed Urban NEXUS design process, also sought to pilot Urban NEXUS methodologies through experimenting with the design process in a very brief and limited resourced project. As a result the project reached the “Design and Deliver” phase in the Urban NEXUS Development Cycle, although the project team would iterate that ideally much more time should be spent on the “Innovate” phase (see also graph on page 3). The next phases of building institutional capacity, communicating benefits to change behaviors, and mainstreaming the solution will need to be carried forward by a team in Dar es Salaam, depending on the future availability of additional project resources.

Physical infrastructure improvements at the schools include: i) improved fuel wood cookstove replacing an open cast fire and improved floor surfaces to ensure cleanliness (in only one school, the other school had an improved stove already); ii) rainwater harvesting catchment system including 120m of guttering and two 10,000 liter rainwater tanks, tank stands and pumps (shared between both schools); iii) Minor renovation of existing leaking water supply system; iv) two sets of drip irrigation pipes for watering gardens; and v) two vertical food gardens (five sets of three meters wide rankings with four rows). Additional items include the construction of a school wall and gate to ensure security (the wall has doubled as an educational mural on sustainability, climate change and the Urban NEXUS approach); and preparation of the roofs for rainwater harvesting.

Physical savings of resources included a reduction in fuel wood utilization for cooking food; a reduction in the reliance on the municipal water system during the rainy seasons, an overall increase in water availability; an increased availability of vegetables for the school feeding program and the potential for income generation; and the utilization of organic waste from the local market.

School learning and education was facilitated via a school project that investigated the understanding of where resources come from. This brought in the angle of the city as being part of a region.

Institutions and policies

At the Ministerial level, water, energy and food supply fall under the responsibility of the Ministry of Water and Irrigation (MWI), Ministry of Energy and Mines (MEM) and Ministry of Agriculture, Food Security and Cooperatives (MAFSC). The Dar es Salaam Water Supply and Sanitation Company (DEWASCo) is responsible for the development of water and sanitation services.

There is a baseline of sectoral policies and plans from which to work that do bear relevance at the local government level in these sectors. Opportunities additionally exist in mainstreaming the National Adaptation Policy (NAP) in the Master Plan of the City and for specific technology and approaches that are supported in policy e.g. solar water pumps supported in the Energy Policy. However, it is clear that possible synergies between the legal and the policy framework should be explored in future NEXUS projects.



School children learning about the NEXUS using Resource Flashcards.

Municipal capacity strengthening, awareness and involvement in the new Urban NEXUS approach was achieved through the project. The Urban NEXUS approach provide a unique opportunity to develop capacity and understanding in order to deliver efficient and resource saving approaches. This also involved integrating practices among different sectors within the municipality, as well as local external stakeholders who provided technical expertise in meeting the needs of the community.

A broad impact on the community was revealed by anecdotal evidence from local partners, who reported that community members are observing the changes. Many community members were passing by to look at the pilot projects and to ask questions about what they can do in their own homes. One further school has already hired service providers to install improved fuel wood cookstoves as done in the pilot project.

Within the duration of the pilot project no specific institutional reforms were yet identified. This may change, however, since an Urban NEXUS Task Force was initiated at the final stakeholder workshop to carry the results forward.

Lessons learned

Faced with the challenge of limited time and resources, the project offered opportunities for creative thinking and co-production of knowledge and solutions. In doing so the following resonated:

The Urban NEXUS project would have benefited from lengthier planning and design time. A longer project time span to include further stakeholder engagement and to bring together a holistic Urban NEXUS team would have resulted in further technological innovations and approaches. Site selections should form part of this stakeholder engagement process as should discussions of different technologies and solutions. This requires an open stakeholder approach, which tends to be time intensive, especially in the case of metropolitan regions with another layer of governance including neighboring municipalities as well as metropolitan authorities.

The Urban NEXUS requires a unique institutional set-up and an understanding of the complex linkages between the metropolitan and municipal bodies. This often means identifying gaps in practice in order to maximize pathways in sustaining the Urban NEXUS approach, through top-down and bottom-up approaches.

The proximity of the municipality in Dar es Salaam to its locality and its role in service delivery has great potential and should be capacitated to employ integrative approaches.

Showcasing on the ground experiences, such as school projects, demonstrates how sectors can work together. There are many further opportunities in Dar es Salaam to coordinate and link tiers of responsibilities for resource efficiency.



Training the school staff on using the improved cookstove.

The value of stakeholder engagement to foster buy-in and behavioral change in coordinating different sectors and components of complex metropolitan systems, highlights the need to consider the following:

- **Secure a conducive environment.** Additional resourcing for in depth high level workshops that create space to focus (take stakeholders away from their municipal work place) are advised for future projects.
- **Design simple but innovative tools to communicate with the community,** especially where a language barrier is a concern: The project addressed this through the use of visual imagery, as well as experiential approaches (e.g. a Resource Walk around the school) and visioning exercises (e.g. the SOAR approach) that would allow the concepts to resonate with the intended beneficiaries.
- **Commitment of local authorities in such an exercise is crucial.** The support and knowledge of the local context provided by municipality partners proved to be helpful in executing stakeholder engagements.

The Urban NEXUS approach amounts to a social-institutional learning process. An Urban NEXUS Task Force composed of local actors from different sectors and expertise is required, guided by an openness to change and completely transform practices. The necessary patience and learning by doing together was developed allowing for a bottom up process.

Political champions that are willing to be open and take on the above are critical for success. Project ownership of the municipality offers key entry points in capacity-building, as it allowed for an intimate look at the project development and stakeholder engagement required for Nexus initiatives, as well as opportunities and potential challenges in its long-term implementation. For example it was identified that the newly formed NEXUS Task Force must be supported by the Mayor to become an effective agent of change.

Small projects can spark big change. As simple a project as this may seem, the Urban NEXUS pilot project has captured the attention of many councilors and thus inspired them to take on a similar role out in their wards and Mtaa's.

Budget and finances

The costs of the project were relatively modest for a pilot project of this nature. Although staff time and costs associated with meetings and workshops received the largest bulk of funding, resources for these activities are necessary in new planning and development approaches. Many of the costs associated with this type of project may already largely exist within typical municipal budgets. However, what sets this project apart are the long lasting benefits it provides to



Kinondoni Municipal Council Urban NEXUS Task Force.

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The Urban NEXUS project included: a baseline study and report (GIZ and ICLEI, 2014), the identification and preparation of case studies and shorter case stories, and the design and implementation of action-oriented pilot projects supported by the German Development Cooperation.

ICLEI, as implementing partner of the Urban NEXUS project, is responsible for the content of this Case Study.

Further Reading

GIZ and ICLEI, 2014, Operationalizing the Urban NEXUS: towards resource efficient and integrated cities and metropolitan regions. Available at: www.iclei.org/urbanexus

the community, the ability to derive additional benefits, possibly create income streams, institutional channels of collaboration, and to showcase and practice a new way of designing service delivery and development.

Replication

Mgonja Yahona: *"For replication, having a champion is important. In addition, each municipality needs to have a proper environmental department."*

In order to enhance the success of replication in Dar es Salaam and in other municipalities in Tanzania and beyond, it is recommended to have the full support of a high level official such as a city/municipal director; someone who has oversight across departments and sectors and can issue directives to undertake a new methodology of planning. Whilst the Mayor's approval is beneficial it is more at the technical level where instructions are issued and followed.

Mussa Natty, Municipal Director: For replication his advice to other municipalities is to *"Start doing it and keep on improving with each project. Don't be afraid to try new things."* His philosophy for this project was *"Let's do something, let's make development improvements!"*

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On behalf of:



This Case Study was elaborated for the Urban NEXUS project 2013-2014.

The ICLEI Case Study series is available at www.iclei.org/casestudies, and focuses on various types of urban sustainability activities of ICLEI Members and local governments that are part of ICLEI projects across the globe.

ICLEI – Local Governments for Sustainability is an international association of local governments implementing sustainable development. ICLEI's mission is to build and serve a worldwide movement of local governments to achieve tangible improvements in global sustainability with special focus on environmental conditions through cumulative local actions.

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