LIRA 2030

Africa

LEADING INTEGRATED RESEARCH FOR AGENDA 2030 IN AFRICA

Key achievements and learnings
(2016–2021)

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CONTENTS

EXECUTIVE SUMMARY

The Leading Integrated Research for Agenda 2030 in Africa (LIRA 2030 Africa) programme was the first research funding programme that sought to build capacity of early career researchers in Africa to undertake transdisciplinary research and to foster scientific contributions to the implementation of Agenda 2030 in African cities, at a continental scale. The programme was implemented from 2016–2021 by the International Science Council (ISC) together with its Regional Office for Africa in partnership with the Network of African Academies of Sciences (NASAC) and with the financial support of the Swedish International Development Cooperation Agency (Sida).

The 2030 Agenda, with its Sustainable Development Goals (SDGs), recognizes the critical role of cities in implementing transformation towards sustainable development. With the fastest urbanization rates in the world, African cities matter more than most to our collective chances of realizing the SDGs globally (Croese and Parnell, 2022). The LIRA programme was launched straight after the adoption of the 2030 Agenda in order to stimulate the new context-specific evidence required for practice and policy-making in sustainable urban development. Recognizing the complexity of the different actors and forces that make up cities, the LIRA programme focused on building the capacity of the next generation of African scientists to work together with local communities, policy and practice to collaboratively rethink urban futures on the continent.

After six years, the knowledge and data generated through the LIRA projects is extensive, and they are not only of academic interest, but also of significance for local communities and policy-makers. All themes dealt with by LIRA projects are central to the 2030 Agenda. Projects produced academic texts on the SDGs in African cities and generated empirical data on urban processes and dynamics in informal and peri-urban contexts, where the most vulnerable populations reside. The LIRA projects are an illustration of the translation of global agendas at the local level. By fostering new place-based partnerships across different sectors, LIRA projects have helped anchor SDGs in local contexts, and increased the local ownership of and responsiveness of communities to the global agenda.

The programme has contributed to shifting the political economy of research on African cities from the Global North to Africa. Over 60 academic articles and over 20 policy briefs have been published. The LIRA grantees also produced various books, reports and publications, Master's and postgraduate degrees, GIS maps, databases, training courses and tools. The projects also generated knowledge on what it takes to undertake transdisciplinary research in diverse African contexts. At the societal level, photo stories, websites, documentaries, blog posts, exhibitions, and visual and verbal narratives of communities have been developed to make the research and its findings more accessible to a wider audience.

The value of the transdisciplinary (TD) approach for understanding and addressing urban complexity in African cities was endorsed by the entire LIRA community. Using this approach demonstrated the benefits of synergies between different knowledge types in generating new evidence of urban function and dysfunction in under-researched areas in African cities. African urban experiments have shown that transdisciplinary practices are effective vehicles for bridging science-policy divides, facilitating the co-production of knowledge and forging much-needed alternate pathways to urban progress.

The transdisciplinary approach highlighted areas where established knowledge was limited and provided opportunities to fill the gaps. Deep research engagements with diverse local contexts have revealed common and differentiated experiences across LIRA projects. It is clear that the varied urban processes

LIRA Annual Research Forum in Senegal, 2019.
Photo: ISC

and dynamics imply that the future of African urbanism is not singular but rather differentiated according to local contexts.

Other benefits that the transdisciplinary approach provided to research on sustainable development across African cities include: understanding community needs and sharpening the research focus on key societal challenges; fostering learning across disciplines, sectors, institutions and cities; reinforcing the agency of stakeholders; forming strategic and long-standing partnerships with local and national authorities, improving the acceptability of research findings and their potential for impact; making research processes more inclusive; deepening social relations and fostering trust, goodwill and commitment among various groups. The investment in relationships across stakeholder groups and disciplines was valued as a means to change the knowledge and governance landscape shaping African cities. The process of knowledge co-production helped to seize the learning potential of local innovations and enabled projects to come up with more efficient designs of solutions that are fit for each local context.

Although the duration of projects was relatively short and many projects' activities were affected by the COVID-19 pandemic, there is evidence that the projects resulted in varied levels of structural changes and/or influenced decisions at the local level. Although impact and attribution are difficult to ascertain, the researchers attributed these successes to use of the TD approach, as it allowed for holistic responses to problems.

The most significant contribution the programme made is the creation of a community of practice of engaged early career scholars who are well trained and practiced in transdisciplinary approaches, across diverse African contexts. Projects from across 22 African countries have experimented with alternate ways of engaging with and influencing contemporary challenges, providing rich experience in steering multiple and differentiated urban transitions which serve

all who live in cities across the continent. The researchers stated that the programme has deepened their knowledge of the fundamental principles of TD research and skills in the practical application of TD approaches; helped them work beyond academic silos and become reflexive TD researchers; developed their leadership skills and enhanced their involvement in local, national and global policy processes; led to increased self-confidence and recognition in their universities and research community, and strengthened international networks with peers and high-level actors around the continent and beyond. Researchers indicated that the LIRA programme influenced their professional development by providing fertile ground for intellectual growth and expanding their networks across Africa and beyond. It is clear that LIRA researchers demonstrated a powerful commitment to reshaping the future of African cities and it is to be hoped that all the skills they acquired from the LIRA experience will help them to reach positions of authority and influence in the future.

The first phase of the LIRA programme also developed and tested an innovative programmatic model for supporting transdisciplinary research and pan-African TD collaborations, lessons from which can be useful for future research funding programmes.

The implementation of the LIRA programme would not have been possible without the generous support provided by Sida; the strategic vision and commitment of the Scientific Advisory Committee; and the enthusiasm and dedication of African early career researchers, LIRA trainers and reviewers, as well as the programme management team. Their collective effort and dedication helped to demonstrate the value of TD research in generating extensive context-specific knowledge and solutions on urban challenges together with societal partners.

Recognizing the urgency and importance of continuing the implementation of SDGs in African cities and the need to scale up systemic interventions, the ISC is working with Sida and partners in Africa to develop the next phase of the LIRA programme, which will be led by an institution based in Africa. The scientific community of highly motivated TD researchers, the established partnerships with societal partners, TD experiences acquired and leadership skills developed will all be important resources for the next phase to build on.

Extract from a book Localizing the SDGs in African Cities**, edited by Sylvia Croese, LIRA grantee, and Susan Parnell, Chair of LIRA Scientific Advisory Committee, with several LIRA grantees as authors.**

Looking to 2030, the date by which the SDGs are supposed to be realized from the vantage point of an African city is daunting. We will not make it. We were never going to. Even before the ravages of the COVID-19 pandemic, the goals were unattainable. Aspirations for building in social, economic, and environmental integrity into the DNA of African cities remain a hope and a goal. But just because the 2030 timeframe is so tight, and the targets and indicators were never designed with the realities of vast informality, extreme and deep poverty, and minimal public investment in mind, it does not mean that the SDG path set out is the wrong one – even for this special continent.

While there are undoubtedly particular African SDG obstacles, there are also African opportunities, not least of which is the energetic and aspirational commitment of residents and across local civil society. In local and national government too, there is a drive to improve African cities and forge more sustainable patterns of urban living. One of the most positive things about the SDG process is that it has made legible the extent to which Africa matters in the overall global conversation. If cities matter to sustainability, African cities matter more than most to our collective chances of realizing the SDGs. Perhaps, the African Union timeline of 2063 is more realistic than the timeline of 2030, but at least the SDGs help guide, rather than distort, urban development for Africa.

If your organization is interested in supporting transdisciplinary research on African urban challenges and solutions, as well as capacity building activities in Africa, please contact lira2030africa@council.science to discuss collaboration opportunities.

'LIRA cohort of people has done more than any other group on the continent to substantially advance volume, quantity and the relevance of urban research on the continent. LIRA is ahead of its time, and it was able to harness significant work and initiate significant shifts in thinking that will anticipate shifts in practice in urban research. Now we need to do more: We need to use LIRA to mobilise the African community of urban scholars to think and act differently and to consolidate and advance what we have built.'

Susan Parnell, Chair of the LIRA Scientific Advisory Committee
Professor of Geography, University of Bristol
Former Executive of the African Centre for Cities, University of Cape Town

'My experience with LIRA has been remarkable. I am glad to be selected to be part of this amazing academic journey. I intend to further enhance the relationship through future collaborative engagements with colleagues, communities and practitioners, we have grown to know.'

LIRA researcher

INTRODUCTION

The 2030 Agenda with its Sustainable Development Goals (SDGs), Agenda 2063 of the African Union, the Paris Agreement on Climate Change, the Sendai Framework on Disaster Risk Reduction and the New Urban Agenda all recognize the critical role of cities in transformation towards sustainable development. As all big developmental decisions will be made in cities, at least in the coming decades, the power and authority of cities in dealing with sustainability challenges will continue to grow on the global stage.

With the fastest urbanization rates in the world, African cities are at the front line of global development. Given that the bulk of urbanization in Africa has not yet taken place, African cities have an unprecedented opportunity to shape their urban futures in an inclusive, sustainable and resilient manner. Decisions being taken now by governments at the national, sub-national and city level will have consequences for the functioning, liveability and environmental sustainability of cities for decades to come. Meaningful contributions to sustainable urban development on the continent will require inclusive and coordinated policies, strategies and actions, which should be based on context-specific evidence and nuanced analysis of urban processes.

To stimulate the new evidence required for practice and policy-making in sustainable urban development, the International Science Council (ISC), together with its Regional Office for Africa, has implemented Leading Integrated Research for Agenda 2030 in Africa (LIRA 2030 Africa), a research programme running from January 2016, in partnership with the Network of African Science Academies (NASAC). Financial support has been provided by the Swedish International Development Cooperation Agency (Sida). The Robert Bosch Foundation provided additional support for capacity building activities. LIRA 2030 was due to end in 2020, but was extended for an additional year due to the COVID-19 pandemic to allow researchers to complete their activities and publish academic articles.

The LIRA programme was launched straight after the adoption of the 2030 Agenda on Sustainable Development. Recognizing the critical role of cities in defining the pathways towards sustainable development, the overarching goal of the LIRA programme was to build the capacity of the next generation of African scientists to lead the innovative rethinking of urban futures on the continent, working with local communities, policy and practice.

Embracing and harnessing urban complexity as well as understanding interactions of different systems within cities is going to play a much larger role in the coming decades. Therefore, science will need to be capacitated to play a much more active role in navigating urban complexity and in engaging with urban transformation. This will require novel methods of knowledge production which acknowledge the complexity, uncertainty and contested nature of urban sustainability challenges. Therefore, the LIRA programme promoted transdisciplinary (TD) research, as this collaborative approach seeks to grasp the complexity of the problems involved and to take into account diverse scientific and societal views of the issues.

More specifically, the programme aimed to:

- Strengthen the capacity of early career scientists to undertake trans- and interdisciplinary, solutions-oriented, and contextualized knowledge generation on sustainable development in African cities;
- Increase the production and use of this knowledge to promote sustainable urban development in Africa;
- Foster African scientific leadership for the implementation of the global 2030 Agenda;

- Foster research collaboration within Africa;
- Create an enabling environment for TD research and capacity building in Africa, and globally.

The LIRA programme was designed to take African early career researchers on a two-year journey that would stimulate collaborative rethinking of urban futures on the continent. This journey included training activities on TD research, practising complex TD projects, generating relevant knowledge on specific urban challenges, creating partnerships with diverse scientists and stakeholders, and informing policy processes at local, national and international levels.

To achieve its goals, the programme focused on:

- Knowledge generation on sustainable development across cities in Africa;
- TD capacity building, networking and peer learning;
- Connecting local knowledge to the global sustainability agenda and processes;
- Communicating research to a wider audience;
- Mobilizing institutional and financial support for TD research and capacity building in Africa, and globally.

This report captures key achievements in these areas, insights and lessons learned by the LIRA programme during its six-year time frame. The achievements of LIRA projects can be found in Annex 1.

OVERVIEW OF LIRA KEY ACTIVITIES (ISC, 2023)

Collaborative research grants (90,000 Euro over two years) were provided to African early career scientists to undertake trans- and interdisciplinary research on global sustainability across African cities that is policy relevant and helps to tackle urban sustainability challenges. Moreover, they were expected to foster research collaboration at regional level between different African countries and research institutions, including low-income countries.

TD capacity building activities were an integral part of the programme and aimed to ensure that early career scientists have the necessary skills and knowledge to develop and undertake policy-relevant TD research. Furthermore, the programme encouraged the projects to undertake TD capacity building as part of their project activities. The programme delivered TD training for Principal Investigators (PIs), and for Co-PIs coaching workshops with modules on, for example, theory of change, the ethics of doing TD research, strategies for publishing TD work, project and financial management of TD projects, science advice to governments, science–policy interactions, science communication and scientific writing.

Leadership and career advancement: The programme aimed to provide international career development opportunities for the early career scientists by nominating them for international scientific committees and conferences, working groups, and intergovernmental policy processes and global reports. Opportunities for participation as well as funding opportunities were regularly shared with the LIRA community. The programme also supported the PIs with project outreach to the broader public via ISC-led production of blogs, videos and webinars.

Peer learning and network building: The programme organized annual three-day research fora to foster community building and peer learning. These fora brought together PIs and Co-PIs of all projects, TD and urban experts, as well as representatives of global research initiatives. Capacity building modules were integrated into the meetings, for instance on science advice to governments, science–policy interactions, science communication and scientific writing. Building a network of African TD sustainability scientists including the 28 selected research projects to enhance South–South collaboration and to foster participation in global sustainability research endeavours such as Future Earth was another key aspect.

Mobilizing institutional and financial support for TD research: To enhance the context conditions for TD research globally and in Africa and to mobilize further funds, the programme held strategic meetings with funding agencies such as national science funders, development agencies, foundations, key regional institutions and other relevant partners. Under the framework of the LIRA programme, two global fora were organized to discuss with science funders how to increase the impact of science on the implementation of the SDGs, during which the critical role of TD research and building associated capacity in the Global South was emphasized.

Learning study: Given that TD research funding programmes are still a niche phenomenon, and suitable structures and activities need first to be defined, the LIRA programme conducted a learning study aiming to foster continuous reflection and learning on how TD can be supported through such a funding programme and how the implementation of the programme can be improved (both on the project and programme level).

Cross-project collaborative grants: The programme funded eight cross-project collaboration grants to foster collaboration and learning across different projects. These grants made it possible to compare and synthesize knowledge from different LIRA projects as well as from experiences of TD research in different African contexts.

Site visits: To understand the progress and challenges of the projects, the programme management organized site visits of several projects and their institutions on an annual basis. When the COVID-19 pandemic happened, those visits became virtual. The visits made it possible to witness projects' progress on the ground; to discuss management issues, needs and challenges; and to maintain strong links with the projects' leadership and partners.

Open access fund: Given that publishing TD research takes time and the fact that the pandemic slowed down projects' activities, the programme created an open access fund for LIRA grantees to publish their articles in open access.

Final LIRA evaluation workshop: To assess the effectiveness of TD approaches in generating actionable knowledge on sustainability challenges across African cities, the programme initially planned to undertake a LIRA evaluation workshop at the end of the programme, inviting the entire LIRA community for reflection on achievements and challenges. However, due to the COVID-19 pandemic the event could not take place. Instead, a series of virtual webinars were organized. The learning study also served this purpose.

Activities that are highlighted **in green** above were not part of the initial programme design, and were added as the programme unfolded, taking into account projects' needs.

KNOWLEDGE GENERATION ON SUSTAINABLE DEVELOPMENT ACROSS CITIES IN AFRICA

To stimulate the new evidence required for practice and policy-making in sustainable development across African cities, the LIRA programme supported early career African researchers (with no more than 10 years of work experience following their PhDs) to co-produce knowledge with policy and society.

Since the programme's inception, **three open calls** have been launched:

- Understanding the 'energy–health' and 'health–natural disasters' nexuses in African cities (2016);
- Advancing the implementation of SDG11 in cities in Africa (2017);
- Pathways towards Sustainable Urban Development in Africa (2018).

The thematic priorities and the content of the calls were shaped by a Scientific Advisory Committee (see box below).

As a result of these calls, the programme has supported 28 collaborative research projects to the value of up to 90,000 Euro each over two years. These explored new approaches to rethinking urban futures in Africa in partnership with local authorities, communities, business and government. Half of the projects were led by female Principal Investigators (PIs).

Each project brought together cities in at least two countries in Africa. The goal was to foster research collaboration across African research institutions and learning across cities. A particular emphasis was on ensuring the participation of low-income countries in research collaboration. A list of LIRA project descriptions and achievements can be found in Annex 1.

Twenty-two countries in Africa are covered by the projects, including Angola, Benin, Burkina Faso, Cameroon, Côte d'Ivoire, Democratic Republic of Congo, Ethiopia, Ghana, Kenya, Malawi, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, South Africa, Tanzania, Togo, Uganda, Zambia, and Zimbabwe.

LIRA SCIENTIFIC ADVISORY COMMITTEE

To oversee the implementation and strategic development of the programme, a Scientific Advisory Committee was appointed in June 2016. The committee included distinguished scientists from Africa (all positions and affiliations are stated as of 2016; they might have evolved since then), stakeholder representatives and leadership representatives of all partners involved:

- **Susan Parnell** – Scientific Advisory Committee Chair – Former Executive of the African Centre for Cities, University of Cape Town, South Africa, former member of the Urban Health and Well-being Science Committee, Professor of Geography, University of Bristol;
- **Cheikh Mbow** – Executive Director, START International Inc., Member of Future Earth Scientific Committee;
- **Nelson Sewankambo** – Professor of Medicine and Principal, Makerere University College of Health Sciences, Uganda;

- **Nick Perkins** – Former Director, SciDev.Net;
- **Peggy Oti-Boateng** – Senior Programme Specialist for S&T and Coordinator ANSTI, UNESCO MSRO for Southern Africa;
- **Samuel Babatunde-Agbola** – Department of Urban and Regional Planning, Faculty of the Social Sciences, University of Ibadan, Nigeria;
- **Shuaib Lwasa** – Chair of the IRDR Science Committee, Department of Geography, Makerere University, Uganda;
- **Elvin Nyukuri** – early career scientist, University of Nairobi, Kenya, Centre for Advanced Studies in Environmental Law and Policy, College of Humanities and Social Sciences;
- **Heide Hackmann** (ex-officio) – ISC Chief Executive Director;
- **Jackie Olang** (ex-officio) – Executive Director of NASAC;
- **Daniel Nyanganyura** (ex-officio) – Director of ISC ROA;
- **Mathieu Denis** (ex-officio) – ISC Science Director.

The committee played a critical role in defining the programme's scientific strategy, making research funding decisions based on the review of research proposals and agreeing on the further development of the programme. The committee met once a year and worked mainly electronically and via teleconferences.

As part of Scientific Advisory Committee meetings, the programme organized seminars with the local scientific communities. For instance, the programme organized a scientific seminar at the Lilongwe University of Agriculture and Natural Resources to engage the local scientific community in a dialogue around the role of science in advancing sustainable urban development in Africa.

Meeting of the Scientific Advisory Committee at the National Commission for Science and Technology of Malawi, 2018, Lilongwe, Malawi.
Photo: ISC

The knowledge and data generated through the LIRA projects is extensive, and they are not only of academic interest, but also of significance for local communities and policy-makers. The PIs highlighted the significance of the LIRA programme in shifting the dominant centres of knowledge production on Africa from the Global North to Africa.

All themes dealt with by LIRA projects are central to the 2030 Agenda. The LIRA projects are an illustration of the translation of global agendas at the local level. The scientific and societal goals of projects were driven by local priorities, addressing conceptual and delivery deficits in local areas while simultaneously contributing to highlighting blind spots in global policy agendas that are misaligned to the complexity of African cities. The projects also highlighted the extent to which there is still a knowledge lacuna about the functioning and systems underpinning urban processes in African cities. In-depth data collection has also provided a compelling picture of urban challenges in African cities and provides insights into the kind of urban science that is required to foster sustainable pathways in African cities. The projects also generated knowledge on what it takes to undertake TD research in diverse African contexts (ISC,2023).

Articles published that involve LIRA grantees

To date, over 60 articles have been published that involve LIRA grantees (see Annex 2). This includes seven articles that have been published through LIRA cross-project collaborative grants to compare and/or synthesize knowledge from different LIRA projects as well as experiences of TD research in different African contexts.

'The cross-project collaborative grant was really a rich and useful experience I very much appreciated. The grant opens the door to the team members to expand their network of partnerships across Africa and to cement the ground for future collaboration. The long time spent with LIRA colleagues working on the joint papers provided us a unique and rare opportunity to co-engage and to continue to progress intellectually in our scientific careers.'

The experience of the LIRA projects confirms that publishing a TD article takes time, and doing it within a two-year project time frame is not always feasible, especially for early career scientists. Having said that, several PIs managed to publish two or three publications over the period of the grant, with plans for further publication. To enable all LIRA grantees to publish their articles in open access beyond the time frame of the programme, the LIRA Open Access Fund was created for 2022.

CROSS-PROJECT COLLABORATION

In 2020, the LIRA programme provided **eight grants** (up to 20,000 Euro) for **cross-project collaboration**, as LIRA grantees emphasized the need for providing opportunities that would help to realize collaboration across LIRA projects. The anticipated output of each collaboration was a joint academic article. Cross-project collaboration grants made it possible to compare and synthesize knowledge from different LIRA projects as well as experiences of TD research in different African contexts.

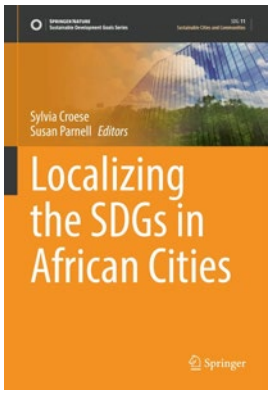
The PIs highlighted this experience of cross-project collaboration as extremely valuable, as it enabled them to cross-fertilize ideas, to learn about working in teams to produce a shared output, to expand their network

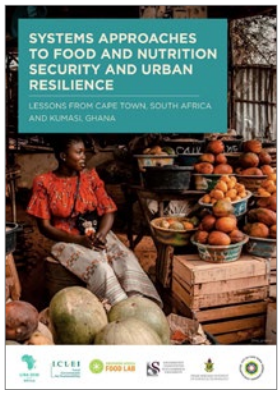
of partnerships across Africa, and to cement the ground for future collaboration. They recommended that cross-project collaboration should form a core component of any TD research funding programme. Seven collaborative articles have been published:

- Kareem, B., McClure, A., Walubwa, J., Koranteng, K., Mukwaya, P. I. and Taylor, A. 2022. Power dynamics in transdisciplinary research for sustainable urban transitions. *Environmental Science & Policy*, Vol. 131, pp. 135–42. https://doi.org/10.1016/j.envsci.2022.02.001
- Ambole, A., Koranteng, K., Njoroge, P. and Logedi Luhangala, D. 2021. A review of energy communities in sub-Saharan Africa as a transition pathway to energy democracy. *Sustainability*, Vol. 13, No. 4, p. 2128. www.mdpi.com/2071-1050/13/4/2128
- Thondhlana, G., Mubaya, C. P., McClure, A., Amaka-Otchere, A. B. K. and Ruwanza, S. 2021. Facilitating urban sustainability through transdisciplinary (TD) research: lessons from Ghana, South Africa, and Zimbabwe. *Sustainability*, Vol. 13. https://doi.org/10.3390/su13116205
- Thiam, S., Aziz, F., Kushitor, S. B., Amaka-Otchere, A. B. K., Onyima, B. N. and Odume, O. N. 2021. Analyzing the contributions of transdisciplinary research to the global sustainability agenda in African cities. *Sustainability Science*, Vol. 16, pp. 1923–44. https://doi.org/10.1007/s11625-021-01042-6
- Sesan, T., Sanfo, S., Sikhwivhilu, K., Dakyaga, F., Aziz, F., Yirenya-Tawiah, D., Badu, M., Derbile, E., Ojoyi, M., Ibrahim, B. and Adamou, R. 2021. Mediating knowledge co-production for inclusive governance and delivery of food, water and energy services in African cities. *Urban Forum*. https://doi.org/10.1007/s12132-021-09440-w
- Odume, O. N., Amaka-Otchere, A., Onyima, B., Aziz, F., Kushitor, S. and Thiam, S. 2021. Pathways, contextual and cross-scale dynamics of science-policy-society interactions in transdisciplinary research in African cities. *Environmental Science & Policy*, Vol. 125, pp. 116–25. https://doi.org/10.1016/j.envsci.2021.08.014
- Vodounon, H., Azalou-Tingbé, E., Houedakor, K., Amoussou, E., Nantob, M., Adoho, G. and Odoulami, L. 2021. Alternative sanitation and strategic directives for the well water security in Cotonou (Benin) and Lomé (Togo). *Journal of Water Resource and Protection*, Vol. 13, pp. 675–98. https://doi.org/10.4236/jwarp.2021.139036

Publications, reports, tools that LIRA grantees developed or contributed to

In addition to academic articles, the LIRA grantees developed and contributed to the development of various books, reports and publications. Some examples include:





EXAMPLES OF PUBLICATIONS

- **Croese, S.** and Parnell, S. (eds). 2022. Localizing the SDGs in African Cities. Sustainable Development Goals Series. Cham, Springer. https://doi.org/10.1007/978-3-030-95979-1_3
- Marrengane, N. and **Croese, S.** 2021. *Reframing the Urban Challenge in Africa: Knowledge Co-production from the South*. London and New York, Routledge.
- **Kushitor, S. B. et al.** 2020. *Systems Approaches to Food and Nutrition Security and Urban Resilience: Lessons from Cape Town and Kumasi.*
- **Keneiloe Sikhwivhilu.** *A Feasibility Study: Understanding the Water–Energy–Health Nexus in Urban Contexts in Africa. Towards Biogas-supported Decentralized Water Treatment System for Communities in Diepsloot (South Africa) and Chambishi (Zambia).*
- **Sylvia Croese** was a lead author for the Africa chapter of the UCLG GOLD V report *The Localization of the Global Agendas*.
- **Alice McClure** contributed to the development of the positioning paper *Transdisciplinarity and Engaged Scholarship.*
- **Sokhna Thiam** contributed to the development of the NASAC report: D. Caussy (ed). 2022. *Protecting Human Health against Climate Change in Africa*. Network of African Science Academies (NASAC) and InterAcademy Partnership (IAP). www.interacademies.org/publication/protecting-human-health-against-climate-change-africa

Other scientific knowledge products produced by projects include Master's and postgraduate degrees, GIS maps, and databases. Some projects developed training courses and tools, such as a course on theory and practice of water–energy–food (WEF) nexus and training tools for intersectoral action for health.

At the societal level, knowledge products including photo stories, websites, documentaries, blog posts, exhibitions, and visual and verbal narratives of communities have been developed to make the research and its findings more accessible to a wider audience. A number of tools have been developed to facilitate stakeholder engagement, for instance the Urban Dream Workshop tool developed by the project in Namibia. Another project created a platform for sharing perspectives on intersectoral planetary health strategies in Africa (Making the 'urban' better).

Policy briefs

During the course of the projects, LIRA researchers engaged government officials at various levels, representing ministries, national and city authorities and agencies. To make research findings more accessible, projects developed **over 20 policy briefs**. One policy brief, *Bolder action for health in Africa*, was disseminated to delegates of the 2019 Inter-ministerial Conference on Health and the Environment through the Regional Office for Africa of the World Health Organization (WHO). Another project on citizen science and air quality significantly contributed to progress in the development of an air quality bill in Kenya.

EXAMPLES OF POLICY BRIEFS

- *Working with little: personalities and food handling practices among vegetable traders in an African city*
- *Decentralized urban water supply services and access to water under urbanization in West Africa*
- *A policy brief for use by the governors in Cotonou and Lomé and other West African coastal cities and relevant societal actors investigated*
- *A case for providing electricity subsidies in urban informal settlements*
- *Upgrading dense informal settlements by building upwards: lessons from an informal settlement in Durban, South Africa*
- *Sanitation and hygiene in the coastal cities of Cotonou and Lomé: which integrated and sustainable approach? (Fr)*
- *Integrated groundwater resources management in the cities of Cotonou and Lomé (Fr)*
- *Health risks and public health economics in the cities of Cotonou and Lomé (Fr)*

- *Integrated socio-ecological systems of sanitation and hygiene for groundwater security in the cities of Cotonou and Lomé (Fr)*
- *Lessons about fundamental changes and demonstrable aspects of transformative adaptation in Durban and Harare*
- *Lessons about holistic and flexible approaches to support transformative adaptation in Durban and Harare*
- *Pathways towards transformative climate change adaptation in Harare*
- *Sharing of sanitation facilities in low income settlements: what, why, and how? A learning brief*
- *Improving sanitation management and quality: an overview of the 'Research on Shared Sanitation in Africa' (RESSA) study*
- *Bridging decentralised renewable energy planning with neighborhood level innovation*

Knowledge products developed at the programme level

At the programme level, several knowledge products were also developed capturing projects' experiences of undertaking knowledge co-production on sustainable development across African cities. Examples include:

ISC. 2020. Advancing the 2030 Agenda in African cities through knowledge co-production: urban experiments led by early-career African scientists

Based on the initial LIRA findings, this report sheds light on what it takes to co-produce TD knowledge on sustainable urban development in Africa, through collaboration between scientists, policy actors, urban practitioners, the private sector and communities. The report identifies opportunities and challenges for this form of knowledge co-production in the implementation of the SDG framework, and provides options for the creation of enabling environments that enhance the capacity of African scientists to undertake this type of research. Authors: Kareem Buyana, Katsia Paulavets, Alice McClure, Tolu Oni, Justin Visagie, Sylvia Croese, Amollo Ambole, Philip Osano, Mabel Nechia Wantim.

ISC. 2023. LIRA 2030: Learning from Practising Transdisciplinary Research for Sustainable Development in African Cities

Building on the experiences of the three cohorts of the LIRA projects, the programme undertook a learning study. The study captures the diversity of approaches of undertaking TD research in different urban contexts in Africa and identifies potential benefits of knowledge co-production with non-academic stakeholders and across the disciplines, as well as understanding conditions under which these benefits occur. The report provides lessons from practising TD research for sustainable urban development in Africa across diverse contexts, which potentially could be applied to other TD research projects in Africa and globally. The study also explores the role of the LIRA programme design in enabling LIRA researchers to undertake TD research.

Findings from the LIRA learning study informed the development of the following articles:

- Schneider, F. et al. 2021. Co-production of knowledge and sustainability transformations: a strategic compass for global research networks. *Current Opinion in Environmental Sustainability*, Vol. 49, pp. 127–42. https://doi.org/10.1016/j.cosust.2021.04.007
- Based on this article, a blog *Navigating towards sustainability: how research networks can make a difference using the 'network compass'* was also developed.
- Schneider, F. 2019. Research funding programmes aiming for societal transformations: ten key stages. *Science and Public Policy*, Vol. 46, No. 3, pp. 463–78. https://doi.org/10.1093/scipol/scy074

- Patel, Z., Schneider, F. and Paulavets, K. 2022. Linking local projects with global processes: learning from transdisciplinary collaborations in African cities. *Frontiers in Sustainable Cities*. https://doi.org/10.3389/frsc.2022.806053
- Schneider, F. et al. Forthcoming. Fostering transdisciplinary research for advancing the 2030 Agenda in the Global South: learnings for funding programmes.
- Paulavets, K., Moore, S. and Denis, M. Forthcoming. Advancing transdisciplinary research in the Global South. R. Lawrence (ed.), *Handbook of Transdisciplinarity: Global Perspectives*. Edward Elgar.

The LIRA programme was also featured in an OECD report on TD research: OECD. 2020. *Addressing societal challenges using transdisciplinary research*. Paris, Organisation for Economic Co-operation and Development.

TRANSDISCIPLINARY CAPACITY BUILDING AND PEER LEARNING

Building scientific capacity of early career scientists to undertake TD research was the key goal of the LIRA programme. Therefore, significant efforts were dedicated to training activities and exchange across projects.

Five-day TD training workshops for the Principal Investigators

The LIRA programme provided three **five-day TD training workshops for the PIs** of shortlisted projects:

- For the first LIRA cohort: TD training workshop in Nairobi, Kenya, November 2016;
- For the second LIRA cohort: TD training workshop in Kampala, Uganda, 28 August–1 September 2017, hosted by Makerere University and the Ugandan National Academy of Science;
- For the third LIRA cohort: TD training workshop in Abidjan, Côte D'Ivoire, 3–7 September 2018, organized in partnership with the Swiss Centre for Scientific Research in Côte D'Ivoire.

The aim of the TD training was to develop a cadre of early career researchers who wish to develop experience in, sustainability research within a TD, action-oriented and reflexive learning paradigm. The training presented theories, methods and examples of TD research. The workshops comprised different kinds of sessions including lectures, videos, practical exercises, role playing, a field visit, and group work. The workshop also allowed the participants to work on their full proposals, including TD methodology.

These workshops allowed **99 early career researchers** to build their capacity to undertake TD research; to support researchers to build meaningful trans- and interdisciplinary projects; to support the development of full proposals; and to strengthen their science communication skills.

Key outcomes of the training workshops were strengthened scientific capacity to undertake TD research, improved quality of submitted proposals, increased number of TD researchers in Africa, increased and strengthened TD training resources and trainers, and increased networking opportunities for researchers conducting TD research in Africa.

Intensive TD trainings and project coaching workshops

Initially, the five-day training workshop was only provided to the PIs with the assumption that they would transfer their acquired knowledge to other research team members, but this did not always prove to be effective. At the request of the PIs, similar **intensive TD trainings** were offered to co-PIs of the LIRA second and third cohorts, with mobilized financial support from the Robert Bosch Foundation. In addition, the programme developed **coaching workshops for PIs and Co-PIs** that included modules on theory of change, the ethics of doing TD research, managing power dynamics, strategies for publishing TD work, and project and financial management of TD projects.

In total, two intensive TD training and two project coaching workshops took place:

- Intensive TD training to co-investigators and project coaching workshop of selected projects, May 2018, Port Elizabeth, South Africa;

Project Coaching Workshop in Port Elizabeth, South Africa, 2018.
Photo: ISC

- Intensive TD training to co-investigators and project coaching workshop of selected projects, November 2019, Accra, Ghana, organized in partnership with Kwame Nkrumah University of Science and Technology. This workshop included a field trip to Old Fadama, Ghana's largest informal settlement established by migrant workers and internally displaced persons. The LIRA researchers were asked to reflect on how to do upgrading of the settlement in a more inclusive way.

In total, 47 researchers attended these training activities.

Annual Research Fora

To foster community building and peer learning, the programme organized annual three-day research fora. These fora brought together PIs and Co-PIs of all supported projects, TD experts and urban experts as well as representatives of global research initiatives. Capacity building modules were integrated into the meetings, for instance on science advice to governments, science–policy interactions, science communication and scientific writing. These fora also sought to foster North–South collaboration and establish links with representatives from other relevant global and national research initiatives. To achieve this, representatives of Future Earth, Integrated Research on Disaster Risk, Urban Health and Well-being, Transformations to Sustainability, as well as local relevant initiatives on sustainable urban development were invited to attend these events and present their initiatives. The opportunities for exchange were highly valued by the grantees.

In total, three Annual Research Fora took place:

- **Annual Research Forum, 13–15 November 2017, Abuja, Nigeria**, hosted by the Nigerian Academy of Sciences and held in conjunction with the 13th Annual Meeting of African Science Academies, during which LIRA grantees could present their research.
- **Annual Research Forum, 25–27 March 2019, Dakar, Senegal**, hosted by Université Cheikh Anta Diop de Dakar in partnership with the Senegal Academy of Science and Technology. The four-day

meeting brought together not only LIRA researchers but also members of the programme's Scientific Advisory Committee and other leading scholars and practitioners on urban research. To reach out to the local scientific community, a public conference on the topic of 'Science for Sustainable Urban Development in Africa' took place at the Université Cheikh Anta Diop de Dakar. The conference brought together researchers and policy-makers to explore the potential of science to support innovative thinking on urban futures in Africa and Senegal in particular.

Annual Research Forum at the Ethiopian Academy of Sciences, 2020, Addis Ababa, Ethiopia. Photo: ISC

- **Annual Research Forum, 17–19 February 2020, Addis Ababa, Ethiopia**, hosted by the Ethiopian Academy of Sciences. This forum not only provided opportunities for peer learning, but the researchers also took part in a training on scientific writing to increase publication success. The training covered topics such as navigating the international research and publishing landscape, identifying suitable journals for a research paper, advice for writing, dealing with peer review, and raising the visibility of publications.

Capacity development activities led by LIRA projects

Almost all LIRA projects undertook various capacity building activities, either on TD research or on specific thematic issues related to research. These activities targeted either other students or researchers within projects' universities or non-academic stakeholders, including community members and policy-makers. Some examples of capacity building activities provided by LIRA projects are provided below:

- Training of undergraduate, Master's and postgraduate students and development of Master's theses;
- Development of introductory course on the WEF nexus covering theory, rationale, practice, governance, challenges and opportunities;

- Delivery of a training on air quality management for health technical officers from the environment and the health departments of the Nairobi City County Government;
- Delivery of the Scenario Workshop in Accra to develop skills and competencies among project partners, city stakeholders, practitioners and planners from the water, energy and agriculture sectors, private sector and NGOs in the design and use of WEF scenarios to inform decision-making and planning for WEF infrastructure investment and governance in Accra and Kampala;
- Building capacities of informal waste workers for engaging with municipal authorities;
- Development of stakeholder engagement tools for local communities;
- Capacity building of local authorities on localization of SDGs achievement at urban scale;
- Workshops to sensitize different communities in Ghana (Jamestown, Korle Bu and Bubuashie) on water treatment processes, pollution and recycled water use.

CONNECTING LOCAL KNOWLEDGE TO THE GLOBAL AGENDA AND PROCESSES

LIRA 2030 provided scientific leadership opportunities for early career scientists. The key goal of these activities was to provide LIRA grantees with an opportunity to present their research to the international scientific community, thus connecting local knowledge with the global processes; to contribute to and learn from the ongoing policy processes; and to expand scientific networks. These activities also helped to increase the visibility of the LIRA research.

On a regular basis, the programme sent announcements of possible opportunities to participate in international scientific conferences, experts working groups, intergovernmental policy processes and global reports. Some examples of events attended by the LIRA grantees include:

- UN Science, Technology and Innovation fora;
- UN High-level Political Forum on SDGs (LIRA grantees also contributed to the development of a position paper);
- International Transdisciplinary Conferences;
- International Conference on Sustainable Development;

Amollo Ambole, LIRA researcher, at the UN STI forum, 2018, New York, USA.
Photo: ISC

- Sida Science Days;
- Future Earth SRI Conference;
- UN-Habitat International Conference on National Urban Policy;
- Science Forum South Africa and Innovation Bridge 2019, South Africa;
- International Conference on Urban Health;
- IPCC Cities and Climate Conference, Canada;
- Next Einstein Forum, Rwanda;
- International SDG Research Symposium: GLOBAL GOALS 2020;
- International Forum on Women and Sustainable Development in Africa;
- Nexus Conference focused on Water, Food, Energy and Climate;
- Third International Conference on National Urban Policy, organized by OECD and UN-Habitat, Kenya;
- African Open Science Platform, South Africa;
- Future Earth Seedbeds of Transformation, South Africa;
- Sustainable African Cities, Ghana;
- Africa Water Week Conference, Libreville, Gabon;
- International Conference on Urban Health, Uganda;
- ISC and NASAC General Assembly.

The programme also supported the participation of the Chair of the LIRA Scientific Advisory Committee in the UCL-Nature Sustainability Commission on the Urban Science-Policy Interface, which contributed to the development of the article Building a global urban science.

LIRA was also promoted at various events to raise awareness about TD research, to mobilize the scientific community to apply for the calls, and to explore potential partnerships.

Conferences and workshops were cited by PIs as important networking and dissemination opportunities, opening up new research opportunities while providing platforms to test and disseminate new ideas and research findings. However, since 2020, due to COVID-19 restrictions, most of the planned engagements had to change, either being postponed or shifting to a virtual format. As a result, the third cohort of the LIRA projects has not fully benefited from this opportunity.

COMMUNICATING TO A WIDER WORLD

The LIRA communication strategy focused on:

- Filling knowledge gaps on urban development for regional and international policy processes;
- Drawing attention to the value of TD research;
- Capacity support for transforming science systems for the twenty-first century.

As part of the communication strategy, the programme supported projects to develop engaging stories about their research in a blog format. This exercise was undertaken to strengthen projects' science communication skills. In Abidjan, the programme also experimented with telling the story of a project through photos.

EXAMPLES OF BLOGS DEVELOPED BY LIRA PIS AND TRAINERS

- World Economic Forum: *The difference between urban intelligence and urban knowledge – and why we need to bridge the gap*, by Zarina Patel
- The Conversation:
  - *How African cities' residents are creating climate change solutions*, by Alice McClure and Gina Ziervogel
  - *Why Nigeria's efforts to support poor people fail, and what can be done about it*, by Peter Elias
  - *Lagos is getting less rain, but more heavy storms. What it can do to prepare*, by Nelson Odume
- SEI: Living with smoke: an insight into people's experience of air pollution in Nairobi's Mukuru informal settlements
- Future Earth: *Water-Energy-Food Nexus*
- ISC: *LIRA2030 research informs implementation of the Sustainable Development Goals in Mozambique*, by Sylvia Croese

In 2020, many projects were actively involved in the dealing with the consequences of COVID-19. They also reflected on its implications for urban development in Africa, health systems, for TD research, etc. They published online articles and blogs as well as took part in the webinars. The ISC provided a platform via its COVID-19 Science Portal to showcase and disseminate this work to the international community. All blogs were disseminated via the ISC website and social media, as well as the projects' networks.

LIRA BLOGS RELATED TO THE COVID-19 PANDEMIC

- *COVID-19 implications on transdisciplinary research in Africa*

By Kareem Buyana:

- *COVID-19: Are cities entering the era of disruptive transformations to sustainability?*
- *Understanding the different characteristics of African cities will be crucial in responding effectively to COVID-19 on the continent*

By Tolu Oni:

- *Slum health: arresting COVID-19 and improving well-being in urban informal settlements*
- *This is the best time to plan for urban Africa's next health emergency*
- *How COVID has revealed the need for a rethink in urban planning*, in World Economic Forum
- *A little chaos could be just what the SDGs need: here's the sense behind it*, in World Economic Forum
- *The right to healthy environments and space for physical exercise*
- *Impact investment's pandemic challenge*, in Project Syndicate

By Daniel Inkoom:

- The implications of COVID-19 on urban development research in Africa

LIRA also developed videos about the LIRA projects and the value of the TD research. The ISC Global Science TV also developed a video with LIRA grantee Tolu Oni on *reimagining society after COVID-19*.

In addition to the projects videos that were developed at the programme level, LIRA projects also produced videos about their research and experiences.

VIDEOS DEVELOPED BY LIRA PROJECTS

- *Changing Course: A look into transformative river management in Durban*, aired at the 2020 *Better Cities Film Festival*. The video, featuring the LIRA project led by Alice McClure, was also used in the opening of the *Durban Climate Action Plan launch*
- *Parkington Project*, project led by Justin Visagie
- Television documentary on "Co-evaluation of socio-ecological sanitation and hygiene system for groundwater security for the city of Cotonou", project led by Henri Totin Vodounon
- *Transdisciplinary Research according to an African Researcher*, by Amolo Ambole
- *Unchecked Injustice* and *Nyongwa: Smoke Chokes*, by Philip Osano
- Tolullah Oni contributed to a BBC video on *NCDs in Africa*
- *Why South Africa is the Most Unequal Country in the World* – Justin Visagie contributed to the production of this video of Le Monde
- *The Prototype Urban Agriculture in Cape Town*, project led by Sandra Boatemaa

Radio/tv/local newspapers

Sokhna Thiam speaking to Dakaractu about interlinkages between health and climate change in Western Africa.
Photo: Extract from a Dakaractu video

Sheillah Simiyu speaking to News Desk about waste management in Kumasi, Ghana.
Photo: Extract from a JoyNews video

A number of projects were invited to radio and tv programmes. Some projects were featured in local newspapers:

- Reconfiguring dense informal settlements is in the policy spotlight – and rightly so;
- SA students build solar-powered, 'kraal' style home – for under R180,000;
- Poor waste management in Kumasi (Ghana);
- Santé et environnement : Ce que révèle l'analyse des données climatiques des stations météorologiques d'Abidjan et de Dakar de 1960 à 2018;
- Changements climatiques et maladies diarrhéiques': D'ici 2030, le taux de décès chez les enfants va augmenter.

To promote the findings, the project led by Sandra Boatemaa together with partners created a virtual photo exhibition to stimulate stakeholder dialogues and learning about use of resources in cities across Africa. Photographers and urban citizens from across the continent were invited to share images to respond to themes of food, water, energy, waste and mobility. They submitted over 600 images from many African cities.

LIRA webinars and podcasts: To showcase the results of the LIRA projects of the second and third cohorts and discuss how COVID-19 affected LIRA research, three LIRA webinars were organized in 2020 and in 2021, featuring not only LIRA projects but also renowned urban and TD experts, including:

- Susan Parnell, Global Challenges Research Professor at the University of Bristol and Emeritus Professor at the African Centre for Cities;
- Edgar Pieterse, Director of African Center for Cities, South Africa;
- Shuaib Lwasa, Associate Professor at the Makerere University and the University of Twente;
- Cheikh Mbow, Director of Future Africa Science at University of Pretoria;
- Zarina Patel, African Centre for Cities, South Africa;
- Dan Inkoom, Professor of Planning, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana, and Visiting Associate Professor, School of Architecture and Planning, University of the Witwatersrand, Johannesburg, South Africa;
- Coleen Vogel, Professor, University of the Witwatersrand, South Africa;
- Roderick Lawrence, Honorary Adjunct Professor, University of Adelaide, Australia.

The ISC together with the journal *Nature* organized the Nature *'Working Scientist' podcast series*, featuring voices from the ISC's network and looking at how including multiple perspectives can create better science. Dan Inkoom from the LIRA community discussed how so-called "ordinary people" in Ghana have much to contribute to his field of urban planning in the episode *Working Scientist Podcast: How can diversity create better science?*

EXAMPLES OF WEBINARS IN WHICH THE LIRA COMMUNITY TOOK PART
Tolu Oni:
→ *Earth Day 2020 and COVID-19: How are environmental and health crises linked?*, organized by Future Earth
→ *Vaccine hesitancy and ethnicity; The joy of catnip; Lake heatwaves*, by BBC
→ *How has the world changed? Urban Health*, organized by INGSA
Sylvia Croese:
→ *Urban resilience*, organized by the Network of African Women Environmentalists
Shuaib Lwasa:
→ *Ocean Decade Virtual Series: Co-designing the science we need for the Ocean Decade*, organized by the Intergovernmental Oceanographic Commission of UNESCO
Philip Osano:
→ *HLPF 2020 side event: Paris minus the SDGs: a formula for inequality?*, organized by SEI

DIVERSITY OF UNDERSTANDINGS AND PRACTICES OF TRANSDISCIPLINARITY ACROSS THE LIRA PROJECTS

The LIRA programme promoted TD research that is focused on societal problem-solving, through in-depth interactions between academic researchers across disciplines and various actors. The value of these interactions lies in the bringing together of diverse knowledge types with the purpose of stimulating sustainable change in African cities.

Based on the LIRA learning study (ISC, 2023), LIRA projects demonstrated the diversity of understanding and practices of TD. Most of the research teams applied a flexible approach to defining and redefining the concept of TD, iteratively and in the local context. Many projects borrowed definitions of TD research from the literature. But in each case, the projects adapted definitions to suit the local context, thereby reconceptualizing TD as part of preliminary workshops with research partners and at different junctures in the research project process. Even when teams shared a common understanding of TD, different degrees of understanding were apparent. Rather than trying to come up with a single definition, the team members tried to reflect and voice how they see TD manifesting in the project.

With the programme unfolding, projects demonstrated a deeper engagement with the meaning and practice of TD in context. TD was approached as more than a method and was understood in addition as both a political and a social practice. There was an explicit acknowledgement that there is a 'need to change power relations in research and shift from extractive to participatory research' and, by doing so, to 'yield sustainable and locally-relevant societal impact'.

Recognizing existing power asymmetries, many projects tried to broaden participation from multiple stakeholders and to ensure an 'equality of voice' by hearing and recording dissenting views without prejudice rather than suppressing them or insisting on consensus. Addressing existing power imbalances in response to urban challenges became explicit in projects methodologies. The projects produced outputs that reflect the different voices, and make visible (and audible) often marginalized contributions from the informal sector. This was seen by participants as a form of empowerment.

The 'art of co-' was apparent across the projects: co-production and the accompanying 'co-s', such as co-design, co-option, co-analysis, co-construction, co-monitoring and co-creating, demonstrating the breadth of the collaborative endeavours across the projects.

Projects used varying modes for identifying project partners within cities and between project cities. Despite differences, all projects identified the significance of conducting desktop reviews (of the literature and existing policy frameworks). Stakeholder mapping exercises and/or multisectoral workshops were also carried out as a means of triangulating and diversifying project partners.

All three cohorts included a range of TD modes of engagement, with different formats used over the lifespan of the projects. PIs emphasized the need to use different formats for different stakeholder groups and for different purposes: 'all formats were effective for their own respective purposes'. Stakeholder engagement was especially useful in the early stages of the projects – in building trust,

project co-design and the framing of the research questions. PIs emphasized the importance of investing time from early on in strengthening relationships between research partners in order to build trust, agree on a common purpose and foster sustained productive partnerships.

A range of TD modes of engagement included inception workshops; co-design workshops; focus group discussions; cross-disciplinary scientific engagement; policy dialogues; parallel scientific, social and policy studies; exploratory visits; and co-creation of solutions with affected communities. Other efforts to engage communities and policy included training project partners in data collection; co-creating solutions and management approaches to service and infrastructure delivery; multi-stakeholder workshops; learning labs; landscape analysis workshops; social embeddedness; themed workshops; community studios; focus groups; and field visits.

With a view to considering the 'fluidity of African contexts', some projects adopted more creative interventions, assisting dissemination and seeking to influence perceptions, attitudes and ultimately behaviour change beyond traditional academic circles. These included an Instagram-based photo competition to encourage grassroots storytelling; the establishment of a food garden to improve nutrition access for children; using upcycled vertical farms; documenting the evolution of a project through photography and video; radio talk shows; and pamphlets printed in local languages. For example, through photography, participants expressed themselves across languages, beliefs, cultures and space and time, drawing out shared lived experience as well as what makes them unique.

Discussion at the Annual Research Forum in Senegal, 2019.
Photo: ISC

Some projects used boundary objects to navigate the boundaries of knowledge and expertise. In several cases, the innovation and/or technology being introduced (e.g. briquettes, house design and sanitation technology) became the object that was used to bridge different knowledge domains. In other instances, photography and other artistic representations were useful boundary objects used to mediate cross-disciplinary learning. In one project, the convergence of different research traditions and methodologies enabled the project to come up with a hybrid approach known as transdisciplinary visual ethnography, which relies on co-producing visual depictions in different media, including photography, technical drawings, symbols and maps – with storylines from local community actors. These are examples of more democratic and egalitarian means of producing knowledge that shifts the power dynamics in knowledge production.

The value of the open-ended and iterative nature of TD research was demonstrated in cohort 3, as they had to revisit and pivot all activities due to the global COVID-19 pandemic. Given the relational nature of transdisciplinarity, the restrictions on mobility and gathering had the potential to derail projects. However, PIs were able to turn this crisis into a window of opportunity and used social media and other digital platforms to sustain engagements, focus on dissemination and deepen the impact of project results (ISC, 2023).

One of the key learnings is that process is as important as the final outcome. Instead of looking for technical panaceas, researchers should be encouraged to build stronger partnerships and processes across institutional boundaries. The process of getting stakeholders around the table to work together on a specific challenge can be much more beneficial than any particular knowledge product or innovation if it leads to a stronger longer-term collaboration between institutions. So the knowledge co-production process can itself be seen as an agent of change (ISC, 2020).

ENABLERS AND CHALLENGES FOR TRANSDISCIPLINARY RESEARCH IN THE AFRICAN CONTEXT

TD research is premised on the assumption that multiple perspectives will result in more useful research outputs and better practice. However, the pathways from new knowledge derived in TD processes to societal problem-solving and sustainable urban change are not solely dependent on the knowledge itself. Structural changes within and between institutions are just as significant, because new knowledge can only be taken up if the institutional setting and culture are able to respond to it and act on it. This section therefore focuses on the non-knowledge-related factors that impacted on the TD research process during LIRA projects (as explored in ISC, 2023).

Given the relational nature of TD processes, key factors that enabled the success of projects and allowed for change to occur included good and frequent communication, capacity development, and the availability of different types of resources. Dominant themes in the enablers of LIRA projects include:

- Dedicating time to gaining trust and buy-in from all partners early in the research process;
- Building a shared understanding of the project and processes by the PI and co-PI through frequent communication and the free flow of information between cities and partners;
- Leveraging personal networks in securing the buy-in of stakeholders, especially within the policy community;
- Engaging with stakeholders individually before workshops and building two-way reciprocal relationships to ensure efficient discussions and equality of voices;
- Using local languages to build trusting relationships with communities;
- Treating learning between disciplines and stakeholders as an opportunity for change;
- Leveraging the credibility built up by research teams and the confidence gained by empowered communities for deeper policy engagement;
- Partnering with credible partners;
- Identifying key resource persons at relevant institutions (e.g. mayors, queen mothers, city officers) to increase the visibility of projects to city authorities, strengthening their commitment, and leveraging leads at other institutions as well as additional resources for further research;
- Amplifying and elevating projects' efforts through windows of opportunity;
- Training representatives from local authorities and communities;
- Co-funding and mobilizing in-kind contributions (e.g. provision of laboratory and meeting spaces, office space and administrative support, provision of equipment and training, as well as direct capacity development for laboratories, PIs and community members) from host and partner institutions to improve project sustainability;

- Using LIRA's reputation and influence to leverage additional resources for further research and advance their careers within universities.

At the same time, the complexity of TD research, with its iterative characteristics and inclusion of numerous actors, also generated a number of challenges that LIRA projects had to navigate (see ISC, 2023):

- **Access and management of project funding** often proved challenging for PIs to control the administrative budget processes within research institutions. The difficulties of transferring funds between universities located in various countries was a significant stumbling block that delayed work. Protracted procurement processes also led to delays. Project funding management for TD research is clearly challenging in university systems that are not set up for working across disciplines, beyond the university, and between different countries.
- **Managing projects administratively and intellectually** was often challenging – as this could involve managing an interdisciplinary team across multiple countries, working across different cities and languages, while meeting all milestones and producing all outputs. TD research required a diversity of skills and competencies from PIs and project teams straddling the knowledge, political and social dimensions of transdisciplinarity. PIs had to wear multiple hats, including those of researcher, communicator, facilitator, investigator and practitioner. These roles could often sidetrack other important tasks such as publication and self-reflection.
- **Time and resources** were cited as the main challenges facing the projects. TD research requires time for building relationships and mobilizing resources for processes that do not always yield tangible outputs. Agreeing on a common goal among various stakeholders also takes time and patience; thus the TD process can be slow. The project teams considered two years to be too short a time for engaging meaningfully in two different countries, making a real impact in society and delivering on scientific publications. Most of the projects therefore asked for no-cost extensions. Other concerns raised included the sustainability of investments in relationships, partnerships and knowledge generation beyond the end of the project funding cycle. Although new and novel ways of working emerged, the project impacts and societal benefits were often delayed. Momentum is required to ensure the full benefits of the projects. The PIs all indicated that there was a need for additional time and resources to consolidate research findings, deepen engagement and enhance the societal outcomes of the projects.
- **At the same time, two years proved a long period for keeping all actors engaged** throughout the project life span. The fluidity of partner participation created challenges around expectations and understanding of the project's goals.
- **TD research is a nonlinear process requiring flexibility and commitment** from all partners involved. It can be challenging to get all relevant stakeholders together in a limited time due to different priorities and time preferences. Identifying the value that the TD process provides for various stakeholder groups is key; without explicit value, it is difficult to secure engagement.
- **Balancing the diversity of often-changing interests, values and goals of various stakeholders** was one of the key difficulties facing projects. PIs had to show dexterity, nimbleness and leadership skills in navigating various interests and managing stakeholder expectations.
- **Developing a common research agenda for more than one city** was difficult for some projects. They had to vary their engagement strategies to allow for the political context and institutional capacity of different settings. Researchers had to accept that research can move in different directions and at different speeds. This meant that solutions had to be flexible and adaptive rather than being a perfect fit.

- **Gaining access and approvals from non-academic actors** such as ministries, departments and agencies was another challenge. Siloed bureaucratic structures, conflicting agendas within government departments, and the non-responsiveness and opacity of government structures posed challenges for projects seeking to work in the policy arena. The lack of continuity in the tenure of civil servants sometimes led to loss of institutional memory of and commitment to projects.
- **Research fatigue and over-research of local communities** was another challenge. When working with communities, some projects experienced issues of trust. The teams had to repeatedly demonstrate good faith with communities and civil society, while explaining the limits of what one project could practically achieve with the resources available.
- **The fragility of relationships** was another challenge experienced by projects. It was easy to lose legitimacy and credibility if something went wrong in the partnership. Therefore, PIs had to work hard to maintain relationships through regular communication and consistent engagement.
- **Transcending disciplinary boundaries and effectively integrating knowledge from multiple disciplines and diverse stakeholders** was one of the main challenges. A lot of reflection was dedicated to questions of legitimacy in knowledge production, which aspects to include, and which to exclude. In this complex process, it is important not only to accommodate and understand other perspectives on the research problem, but also to find amicable ways of disagreeing and still moving forward to address the problem.
- **Translation, not only across different languages but across different disciplines**, presented difficulties. Project teams reported issues with jargon from different disciplines, and with transforming it into accessible language for stakeholders.
- **Communicative and cultural differences** were also apparent between partner cities, especially when mixing anglophone with francophone or lusophone countries. Another language challenge was the difficulty of translating TD and sustainability concepts across the different languages while maintaining meaning. It was consequently sometimes difficult to come to a shared understanding. Integrating knowledge between case study countries was complicated by language, connectivity and physical distance issues, but also by differences in the countries' local context, with significant variation in institutional readiness and basic governance. Different political situations and different levels of policy development and connectivity made it difficult to synchronize activities in partner cities.
- **Publishing TD research takes time** that can have consequences for academic careers. Outlets for publishing TD research are also limited. Furthermore, collaborative academic work is often not rewarded within universities; articles with a single author get higher scores, and their authors get higher chances of promotion. In such a context, researchers practising TD research are often penalized for collaborative work.
- **Obtaining ethics approval** for a TD project was also a challenge due to the iterative and emergent nature of the research. It was often difficult to provide the level of detail and certainty in research methods required by the ethics procedures of universities.
- **Political unrest and instability** caused delays in some projects.
- **The COVID-19 pandemic** significantly affected the implementation of the projects, and especially those in cohort 3. The pandemic presented the greatest challenge to the TD process, particularly for joint activities and stakeholder engagement, and disrupted the timely implementation of field activities. Projects had to shift from face-to-face engagements to smaller groups, virtual meetings and telephone interactions. University laboratories that were key for experimentation and generating data to support the research had to be closed.

RANGE OF PROJECT RESULTS

To investigate the effectiveness of the TD approach in helping to address complex challenges in the African urban context, the LIRA learning study (ISC, 2023) identified four categories that capture the impact of LIRA projects: knowledge products (presented above); enhanced capacities and opportunities; network effects; and structural changes and decisions.

Enhanced capacities and opportunities

The LIRA projects helped to build capacities both on the individual and societal levels. On the individual level, based on the researchers' feedback, the programme has helped them work beyond academic silos and become reflexive TD researchers; developed their leadership skills and enhanced their involvement in local, national and global policy processes; led to increased self-confidence and recognition in their universities and research community; and strengthened international networks with peers and high-level actors around the continent and beyond.

More specifically, the researchers indicated that the programme helped them to acquire the following abilities, skills and experiences:

- Deeper knowledge of the fundamental principles of TD research and skills in the practical application of TD approaches;
- Ability to link research with local needs, priorities and interests;
- Improved ability to balance the diversity of interests, values and goals of the different interested and affected stakeholders;
- Ability to break out of academic silos and to work with non-academics in identifying a collective problem;
- Enhanced interpersonal and group communication skills for collaborative problem solving;
- Community engagement and facilitation skills;
- Critical thinking and evaluation abilities;
- Access to broader theory and data, and to novel research methods, tools and analytic techniques, from various disciplines;
- Experience in leading and managing complex regional projects involving TD research teams;
- Team-building skills and diversity management;
- Supervision of TD research undertaken by Master's students;
- Exposure to policy processes;
- Improved grant application skills;
- Financial and project management skills;
- Networking skills;
- Scientific writing skills and the ability to be published in peer reviewed journals.

'The LIRA programme has helped to deepen my understanding of TD research and also how to effectively manage project across international borders within Africa. It has also helped me to better appreciate the nuances and complexities involved in TD research, beyond the theoretical and conceptual abstraction of the term. I'm really very much better placed to undertake TD research going forward. Very importantly, drawing on the insights and knowledge I have gained through the LIRA project, I have been able to write much better integrated TD research proposals, and two of such have been funded.'

The PIs also indicated that they strongly benefited from the cross-project collaboration, as they learned about different TD experiences and practised working with various teams to produce shared outputs.

Researchers indicated that the LIRA programme influenced their professional development by providing fertile ground for intellectual growth and expanding their networks across Africa and beyond. Several grantees were awarded with direct career progression and mobility recognising their role in TD projects. Without exception, all researchers stated that they would like to continue using TD approaches in their future research and that they feel galvanized to pursue a career as TD researchers. However, while several grantees were awarded with direct career promotion and funding, securing long-term career development as TD researchers remains a challenge in Africa and elsewhere.

'The LIRA programme was really a rich and useful experience. It was great learning by doing experience we very much appreciated. The programme provided us with an opportunity for intellectual advancement in our scientific career and personal development and for practical insights into the contribution of TD to the SDGs implementation through in-depth knowledge exchange, methods and concepts sharing. It will increase for sure our chances of being promoted at our institution and of receiving additional grants for upscaling our research. As a principal investigator, the programme has enabled me to develop some of the critical soft skills such as communication, leadership, coordination, and diversity in project management.'

On a societal level, almost all PIs undertook capacity building activities as part of their projects. These activities targeted either Master's students and postgraduates within the projects' universities, or non-academic stakeholders including community members and policy-makers.

TD projects also stimulated social experimentation and social learning processes. Novel, reflexive methods of stakeholder engagement and knowledge generation, such as the learning labs and transdisciplinary visual ethnography practised by some LIRA projects, have shifted preconceived assumptions, resulting in new insights and interventions.

Through engagements, TD approach also enabled new insights into conducting research. The process of conceptualizing TD research helped to point out flaws in proposed research methodology and its feasibility, reliability and validity. Through processes of co-learning and adaptation, the TD approach allowed research to be responsive to lessons learned in the field, learning by doing and adjusting accordingly.

Network effects

The LIRA experience strengthened existing networks while facilitating the establishment of new networks, both within and outside the LIRA community. The PIs indicated that the projects helped to strengthen collaborations between universities in project cities and with local partners. New partnerships were established that included platforms, nexus fora, training centres, water quality laboratories, academic groups with a diversity of expertise, a regional scientific consortium for TD research, and collaborations with media, civil society organizations and local start-ups.

Such network effects were a dominant theme that emerged from LIRA projects. They helped expand the partnership portfolio of cities and highlighted the value of exchanging knowledge between countries and sharing learning between partner cities, PIs and Co-PIs.

There are multiple examples of new collaborations established between universities within and across countries, and these provide a platform to foster the exchange of knowledge, skills and experiences between various partners, as well as to ensure the sustainability of project outcomes. Interacting with decision-makers also provided an opportunity for project outputs to be mainstreamed into policies and strategic plans.

Partnering with stakeholders enabled some projects to leverage additional resources, capabilities and funding. Engaging stakeholders at different levels made it easier to access key resources, such as data, facilities, staff time, equipment and transport. Some projects mobilized additional financial support for projects (e.g. fellowship grants, training toolkits, publication costs, communication activities and conference travel). Supplemental funding from alternative sources such as the Belmont Forum, National Research Foundation of South Africa, International Development Research Centre, Africa Multiple Cluster of Excellence and German Federal Ministry of Education and Research was mobilized by some PIs to continue the work initiated by the LIRA projects or to disseminate their project outputs.

Beyond the project cities, networks across projects were developed through the LIRA training and Annual Research Fora events, as well as through cross-project collaborative grants. Networks with the ISC, NASAC, UN agencies and international research institutes were identified as positive enhancements to these networks. The PIs participated in global events and promoted their research through these worldwide platforms. Some projects established strong connections with global research initiatives, such as Future Earth.

Structural changes and decisions

Although the duration of projects was relatively short (two years) and many projects conducted activities during the COVID-19 pandemic, there is evidence that the projects resulted in varied levels of structural changes and/or influenced decisions at the local level. Although impact and attribution are difficult to ascertain, there are some clear examples of direct impact of two-year projects, falling into two categories: new knowledge, as described above, and new processes and structures.

With regard to new processes and structures, some examples include:

- The project in Lagos catalysed structural changes in operations at the State Urban Renewal Agency by facilitating synergies and collaborations across agencies.
- In Mozambique, the project was instrumental in facilitating the preparation of the country's SDG Voluntary National Review and contributing to a collective Voluntary Local Review for municipalities.

- In Durban, transformative adaptation was added as an agenda item to meetings of the Environmental Health Services as a result of their engagement in the learning labs. In Harare, meanwhile, a climate change desk was established under the Town Clerk.
- In Angola, the government invited the project to support the development of the National Housing Policy, and in South Africa the results are being fed into a review of the informal settlement upgrading policy of eThekwini. The team was also included in South Africa's COVID-19 informal settlement policy and technical platform.
- In Cape Town, the prototype of the vegetable garden developed by the project was included in the City of Cape Town's housing architecture.

The PIs attributed these successes to use of the TD approach, as it allowed for holistic responses to problems.

Other examples of innovations include the introduction of sanitation technology solutions, improved energy technologies coupled with changes in energy use practices, and development of double-storey housing designs. In addition to the introduction of these new interventions, some findings could be considered innovative because they shifted preconceived assumptions. Projects also developed valuable tools for city planning and responsiveness to urban challenges, especially in cities with substantial informal sectors. These included context-specific and locally derived indicators and databases, such as an indicator framework for the WEF nexus; a database on sanitation, water, health risks and socio-ecological mechanisms; and a database of market vendors.

In several projects, the outcomes were maximized by either combining projects or leveraging one project's network to extend its impact beyond the time frame of LIRA. At the same time, PIs acknowledged that it takes time to see the impact of projects seeking to influence policy to come to fruition. It is expected that project outputs such as policy briefs, technical manuals and partnerships built have the potential to influence change at the policy level in the long run.

Jackie Kado, ex-officio member of the LIRA Scientific Committee at the LIRA Annual Research Forum, 2019, Senegal. Photo: ISC

VALUE OF PRACTISING TRANSDISCIPLINARY RESEARCH

All projects indicated that TD was a very useful approach in advancing their projects' objectives. The PIs identified several benefits that the TD approach provided to research on urban development across African cities. Firstly, the TD approach helped them understand community needs and sharpen the research focus on key societal challenges, thus generating research with impact. One of the most common sentiments expressed by projects was that TD research provided an important opportunity for stakeholders – policy-makers, civil society, practitioners and academia – to sit and learn together in non-formal interactions on common societal goals. The TD approach created a forum for critical discourse and knowledge co-production among relevant stakeholders, thereby linking society and science. Overall, the TD approach helped to break prevailing patterns of working in silos and fostered learning across disciplines, sectors, institutions and cities. By reinforcing the agency of stakeholders, TD helped to form strategic and long-standing partnerships with the local and national authorities, deepen social relations and foster trust, goodwill and commitment among various groups.

The investment in relationships across stakeholder groups and disciplines was valued as a means to change the knowledge and governance landscape shaping African cities. The shifting configuration of actors in the research processes resulted in a sense of ownership of the project by the societal actors. The depth and longevity of the partnerships built through the projects were identified as valued attributes of TD. The PIs noted that institutionalizing these relationships and engagements is key to them transcending personal networks and becoming more democratic, transparent and accountable in the long term.

At the same time, crafting usable knowledge requires a healthy dose of realism. The real world is far too complex to expect interventions to have neat, predictable outcomes, and small actions in one area can have large and unintended outcomes in others. This means that it is critical to understand contexts and interdependences. Here, capturing differences across different cities and identifying context-specific solutions through the TD approach proved valuable. Working between two cities demonstrated the extent to which emergent TD research processes require flexibility in research design in different contexts within projects sharing the same goals and objectives. The PIs underlined that context drives process, and solutions and processes that generate success in one context cannot simply be 'cut and pasted' into another. The process of knowledge co-production helped to seize the learning potential of local innovations and enabled projects to come up with more efficient designs of solutions that are fit for each local context.

The research flexibility offered by TD and its emphasis on the local context were seen as vital for fostering greater receptiveness from stakeholders, thus improving the acceptability of research findings and their potential for impact.

The value of the TD approach for understanding and addressing urban complexity in African cities was endorsed by all PIs. Using the approach demonstrated the benefits of synergies between different knowledge types in generating new evidence of urban function and dysfunction in under-researched areas in African cities. The approach highlighted areas where established knowledge was limited and provided opportunities to fill the gaps. Generating and sharing locally grounded knowledge between different stakeholders was highlighted as an undoubted key benefit of TD research.

Continuous reflection and the close engagement fostered through the TD approach also enriched research, helped researchers see diverse ways of knowing, made research more inclusive, and allowed for informed changes in research ambition and methods used. The TD approach also encouraged the teams to reflect and pay attention to the need to understand not only the governance landscape but also the structural issues that underpin governance, such as power, gender, political processes and poverty. This reflection enabled a better understanding of the causes of problems, the blockages that cause bottlenecks in responses to these challenges, and the logics behind government responses or the lack thereof.

While TD is often considered a slow process, several PIs stressed that the TD process was effective and time saving, as cause and effect could be identified simultaneously. Partnering with stakeholders also helped them reduce research costs by mobilizing external capacities, facilities and resources. The open process of TD allows projects to make use of opportunities that arise over the course of the research.

MOBILIZING INSTITUTIONAL AND FINANCIAL SUPPORT FOR TRANSDISCIPLINARY RESEARCH

Since its inception, the LIRA programme advocated for TD research. To this end, the programme supported several synthesis activities to showcase the projects' experiences in doing TD research in African contexts and demonstrate the value of TD research (ISC, 2020). The programme and projects were invited to showcase projects' results and the value of TD research in different conferences and fora. The programme also communicated about projects results and the associated role of TD through blogs and videos via the ISC website and global networks. LIRA grantees promoted TD research within their universities, through their projects, capacity building activities and involvement of Master's students in their projects.

Despite significant efforts by LIRA and other similar initiatives to produce articles, syntheses and capacity building activities, current institutional conditions in Africa are still not conducive to TD research. Limited institutional recognition, unyielding disciplinary silos, inflexible institutional policies and processes, inadequate administrative support for internal grant management, and limited opportunities for long-term TD career development are among the factors that still inhibit TD research from becoming a more widespread practice. Mobilizing financial support for TD research is a difficult process for projects themselves, and not all of them manage to do it.

Despite these challenges, several LIRA grantees indicated that there is a positive dynamic in how TD research is perceived within their institutions, acknowledging the importance of TD research in responding to complex challenges. Several grantees stated that through the implementation of the projects the administration learned a lot about how to facilitate TD projects. Several projects did manage to raise additional in-kind or financial support for projects activities (e.g. support for workshops with stakeholders, staff time, training activities, communication activities, additional fellowship grants, publication costs or conference travel).

Creating an enabling environment for TD research is critical in Africa and in the world. In this context, in 2019, under the LIRA framework, the ISC launched an initiative known as the Global Forum of Funders to convene science funders – representing national research funding agencies, international development aid agencies and private foundations – to explore collaborative actions for maximizing the impact of science and science funding on the achievement of the 2030 Agenda for Sustainable Development. This initiative emphasizes the critical need for science funders to increase support for TD knowledge creation globally.

The initiative is led by the ISC in partnership with Sida, the National Science Foundation (USA), National Research Foundation (South Africa), International Development Research Centre (Canada), UK Research and Innovation, International Institute for Applied Systems Analysis (Austria), Future Earth, and the Belmont Forum.

During the course of the LIRA programme, two Global Fora of Funders were held. The first took place on 8–9 July 2019 in Washington, D.C., hosted by the US National Academy of Sciences. At this Global Forum of Funders, science funders and the research community initiated an ambitious "Decade of Global Sustainability Science Action", through which they seek to:

- Apply a holistic and systems approach to tackling pressing global challenges, treating the SDGs as an indivisible agenda;
- Support transformative, high-impact and transdisciplinary knowledge creation;
- Promote mission-driven research, but also harness the contributions of fundamental research;
- Support enabling activities, e.g. capacity development and knowledge brokerage.

The event was featured in the article Expansion of sustainability science needed for the SDGs published in *Nature Sustainability*.

At the first Global Forum of Funders, the ISC was asked to convene the insights and ideas of the global scientific community on the critical priorities for science that will support and enable societies to accomplish the SDGs by 2030. To this end, in 2020, the ISC defined and launched a global call for inputs in October 2020 to shape a priority action agenda for science, which formed the basis for the development of the report *Unleashing Science: Delivering missions for sustainability* that was discussed at the Second Global Forum of Funders in April 2021. The collected inputs not only informed the development of the *Unleashing Science* report, but also provided valuable insights on research gaps and priorities which, if pursued, could support the impact that the Sustainability Science Missions seek to accomplish. These insights are captured in A synthesis of research gaps. The intention of this synthesis is to help guide future scientific and science funding action.

The *Unleashing Science* report was presented at the Second Global Forum of Funders, which was attended by over 130 participants from more than 70 countries, representing the leadership of research councils, development agencies, philanthropies, UN and policy agencies, who contributed to virtual discussions held over three days.

The *Unleashing Science* report offers an ambitious approach – a concerted effort to produce actionable knowledge through a set number of Sustainability Science Missions – in the critical areas of food, energy and climate, health and wellbeing, water, and urban areas. Scaling up science investment to strongly and sustainably support Sustainability Science Missions, united around a common sustainability agenda, provides a real opportunity for mobilizing and putting to use the best global science for societal transformations in an outcome-driven, coordinated and integrated manner.

Delivering the Sustainability Science Missions will require broad and bold engagement and commitment, from science funders but also from decision-makers and influencers in governments, in the private sector and in civil society. At the Second Global Forum of Funders, the ISC was mandated to lead on the development of a process to convene the necessary voices, jointly designing the way forward: to identify institutional arrangements and financial mechanisms that will be required to deliver global science missions.

Following the Global Forum of Funders, the ISC promoted the mission-oriented science at the 2021 UN High-level Political Forum, Annual Meeting of the Global Research Council, and at the SRI 2021 conference.

As a way forward, the ISC established the Global Commission on Science Missions for Sustainability to mobilize a global fund for Sustainability Science Missions. Chaired by Helen Clark, former Prime Minister

of New Zealand, and Irina Bokova, former UNESCO Director General, the Commission is made up of more than 20 committed experts, from former ministers and financiers to research leaders and filmmakers, and aims to build actionable mission-led pathways in the face of existential risks to humanity. In 2022, the Commission with the recommendations from the Technical Advisory group identified a possible model for delivering Science Missions for Sustainability, which will be launched in 2023.

Based on discussions at the Global Fora of Funders, the awareness among science funders for creating an enabling environment for TD is growing, but opportunities for practising TD are still limited. To change prevailing institutional practices and policies, continuing strategic dialogues with key actors, including science funders, universities and science policy-makers, will be key.

Katsia Paulavets, LIRA programme manager at the transdisciplinary research training in Abidjan, 2018, Côte d'Ivoire. Photo: CMAPPING

KEY LESSONS LEARNED

Based on the six-year LIRA experience, the PIs and the LIRA management team generated a number of insights into what can be learned from the application of TD in African cities and from the management of a TD research funding programme. A detailed description of lessons learned, both at the project and programme levels, is provided in the LIRA learning study (ISC, 2023) and the synthesis report (ISC, 2020). This report provides a brief overview of key lessons learned.

At the project level, PIs reported the following insights from practising TD research:

- Be responsive and flexible: learn continuously and adapt your interventions accordingly.
- Understand context well.
- Be inclusive, and partner early and often, but be realistic and strategic about engagement.
- Understand the interests, values and expectations of various stakeholders from the outset.
- Practice active listening and be open to various ways of knowing.
- Think about ways to interrupt the reproduction of unequal power relations.
- Look for windows of opportunity.
- Knowledge products, be they well-written reports, articles or policy briefs, are not enough. They are the start and not the end of a research process.
- There are no easy guaranteed wins; bringing a societal change requires the long-term commitment of all stakeholders involved.

At the programme level, key lessons can be summarized as follows:

- **The combination of research grants, capacity building and career development opportunities is an appropriate programme approach** for fostering TD leadership by early career researchers, because the grantees gain theoretical knowledge, as well as hands-on experience, by leading their own TD research projects and enhance their opportunities to pursue careers as TD researchers beyond the programme funding.
- **Research grants must match projects' outcome expectations in terms of funding time and volume.** Implementation of TD research projects in two countries, including achievement of scientific and societal impact, requires adequate time (more than two years) and sufficient funding for collaboration and coordination activities. Research funding programmes should carefully design project structure and selection criteria to minimize unnecessary complexity and increase project feasibility. The LIRA programme showed that TD projects require support structures from inception to closure.
- **To select high-quality TD projects, a funding call must be very clear regarding TD requirements and criteria**, involve TD expertise in the review process, and give enough time for co-design of the project proposals together with different disciplines and societal actors. A two-step application process with a TD research training course between the pre- and full proposal and tailored feedback from experts and programme management was shown to strongly improve the quality of project proposals. Building a community of reviewers with TD skills is also key.
- **Capacity building should ideally cover the whole 'value chain' of TD**, because leading a TD research project requires competencies that most university curricula still do not foster. Required

competences include managerial and facilitation skills (e.g. project management, basics of financial management and project planning), scientific publishing and ethics.

- **Academic institutions' prevailing culture of competition, lack of reward for collaborative work, limited institutional support, and complex administrative practices and policies are still not conducive for TD research.** The administrative processes and existing institutional challenges of many African universities in accessing funds, procurement and financial transfers between countries should be addressed. This can include support of the involved institutions as well as more flexible contract conditions. Project budgets should include sufficient resources for administrative support. Training grantees in financial accounting at the early stage of their projects is also beneficial.
- **To minimize complexity, future research funding programmes should carefully consider whether research collaboration should be a requirement from the outset or be introduced towards the end of the research process** (e.g. through cross-project collaborative grants). Although research collaboration across countries was enriching, administrative hurdles and differences in language and institutional, economic and political contexts made management of TD research challenging for early career scientists.
- **Self-understanding of a programme as a learning organization is crucial** when implementing innovative TD research funding programmes, allowing the organization to continuously reflect and improve programme-level activities. Considering the novelty of managing such experimental programmes, it was fruitful to establish a concerted monitoring and learning process over the whole duration of LIRA. Future programmes should seek to streamline and lighten their monitoring and project reporting processes, and should also identify ways of capturing the experience of the non-academic partners in the research process.
- **Site visits are important to understanding the progress and challenges of projects.** These visits made it possible to witness projects' progress on the ground, to discuss management issues, needs and challenges, and to maintain strong links with the projects' leadership and partners.
- **Synthesis of the knowledge produced by all projects is a critical element of a research funding programme.** The synthesis of initial learnings of eight LIRA projects from cohorts 1 and 2 was captured in the report *Advancing the 2030 Agenda in African cities through knowledge co-production*. However, the development of a synthesis of all produced knowledge was interrupted by the pandemic.
- **Being attentive to projects' needs and challenges requires adequate human resources and financial capacity for the programme management** to design, support and reflectively monitor the various activities at the programme level.
- **Funders as well as funding mechanisms should be flexible enough to accommodate changes** that occur during the TD research process, given its emergent nature. In this context, the responsiveness of Sida to projects' needs, its flexibility and its openness to experiment were strongly appreciated.
- **Because process is as important as the final outcome, TD research requires changes within existing funding practices.** The process of getting stakeholders around the table to work together on a specific challenge can be much more beneficial than any particular knowledge product or innovation if it leads to a stronger longer-term collaboration between institutions. Therefore, research funding should not only support the production of knowledge products but also engagement processes that could lead to mindset change in the long term. Allocating resources in project budgets for partnership building, capacity building and networking activities is crucial in this regard.

- **There is also a need for a shift in research and capacity building funding from the short-term and project-based to a more sustained long-term process.** While LIRA's two-year project time frame and funding amounts were sufficient for building relevant partnerships and co-producing the required knowledge, the amount of funding and its lifespan were not always enough to put the knowledge generated into use. Most projects had to ask for no-cost extension to advance the implementation of their projects and publish their results. The LIRA experience shows that to witness long-term transformative change in cities, research projects and their funding need to be sustained over longer periods. The PIs indicated that at least three years was needed to advance the implementation of project goals.
- **Finally, continuing strategic dialogues with key actors is crucial**, including with science funders, universities and science policy-makers, to create a more enabling environment for TD research in Africa.

CONCLUSION

Numerous participants in the LIRA programme have recognized it as an innovative and promising model for funding programmes aiming to foster African leadership in TD research. Evaluations from grantees, trainers and Scientific Advisory Committee members reinforce the success of the overall programme design and activities and call for upscaling.

In summary, the first phase of the LIRA programme (2016–2021) has:

- Established a network of 28 urban projects across 22 African countries that have used TD methods to bridge the science–policy–society divide;
- Built an enthusiastic community of TD researchers with strong interest in continuing to undertake TD research;
- Motivated researchers to focus their research on global SDGs at the local level;
- Generated context-specific knowledge on urban sustainability challenges, including through academic articles, policy briefs, books and blogs;
- Designed and delivered TD training activities for early career researchers;
- Undertaken a learning study to analyse the programme- and project-level lessons for practising TD research across Africa cities;
- Facilitated collaboration across cohorts through collaborative grants;
- Developed and tested a programmatic model for pan-African TD collaborations.

The scientific community of highly motivated TD researchers, the partnerships established with societal partners, the TD experience acquired, and the leadership skills developed will all be important resources for the next phase to build on. Looking ahead, we conclude that the next phase of LIRA needs to apply key elements of the first phase's programmatic model while integrating its lessons:

- Continue the promotion of trans- and interdisciplinarity, with a strong focus on TD capacity building.
- Extend the life span of research projects from two to three years.
- Encourage research collaboration across countries, but do not make it obligatory, given the complexity of TD research as well as existing institutional barriers associated with funds transfers. The focus will be on fostering research collaboration across countries at later stages through dedicated cross-project collaborative grants.
- Strengthen synthesis work of generated knowledge and connect it to policy processes, particularly at the regional level. Overall, there will be a stronger focus on science–policy–practice dialogues at the programme level.
- Continue strategic dialogues with key actors, including science funders, universities and science policy-makers, to create a more enabling environment for TD research on the continent.

Based on the findings of the LIRA learning study, we believe that the value of TD approaches is that they contrast with one-size-fits-all best practice approaches by requiring deep engagement with local contexts through constituting and nurturing relevant project teams. The uniqueness and individualized approaches adopted across the LIRA projects show that Africa will, and must, have multiple urban futures. It is important to acknowledge the LIRA scholars who have made significant contributions to shifting the political economy of research on Africa by destabilizing the dominance of researchers from the Global

North. The extent of uptake of findings and approaches, with evidence of structural change and shifts in mindsets, is providing a glimpse of the potential that investments in TD research can have for realizing relevance through research in African cities. The first phase of the LIRA programme has made its contribution to advancing TD research and building an enthusiastic TD community of practice. We hope that the next phase will further contribute to the transformation of science systems in Africa, pushing TD research from an emerging form of research into a mainstream endeavour.

LIRA transdisciplinary training in Abidjan, 2018, Côte d'Ivoire.
Photo: CMAPPING

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ANNEX 1: PROJECT DESCRIPTIONS AND ACHIEVEMENTS

Cohort 1

1

LIRA PROJECT

Renewable energy for sustainable water supply for communities in urban settlements

This project contributes to SDG 6, SDG 7 and SDG 11

This LIRA project (2017–2019), led by **Keneiloe Sikhwivhilu at MINTEK, South Africa**, examined whether renewable energy sources could be exploited to support sustainable production of clean drinking water in the township communities of Diepsloot in Johannesburg (South Africa) and Chambishi in Kitwe (Zambia). Both project communities are located on the outskirts of their respective cities and they face common challenges: they both have gaps in the supply of essential public services (particularly water and energy) which are exacerbated by rapid population growth, and they both experience a plethora of socio-economic challenges. The project generated data on the availability and accessibility of clean water in both communities. It also investigated ways in which renewable energy could be used to facilitate sustainable provision of safe water through decentralized supply, minimizing the communities' reliance on municipalities. The aim is to use the data generated to inform more sustainable and participatory urban planning and policy-making.

Expertise and partners involved: The project involved a multidisciplinary team of researchers based at MINTEK, the Human Sciences Research Council, South Africa and the Copperbelt University, Zambia. The researchers were drawn from the fields of chemistry, water and wastewater treatment, systems, industrial and environmental engineering, renewable energy systems engineering, geoinformatics, and human behavioural sciences. The research team worked in collaboration with communities, the private sector and government actors in different configurations of public/private and centralized/decentralized systems in the project cities. These included providers and regulators of energy, water and sanitation services; private and civil society organizations working in water, sanitation and energy; national government departments in charge of energy, health, water and sanitation; and local government authorities.

Methods to deliver research: The project employed research methods from the natural and social sciences. The team conducted a baseline assessment of the study sites for a future health impact assessment through questionnaires administered to a total of 700 households in the project communities. The key indicators measured in the baseline assessment study were: access to clean, safe, and adequate water; access to clean and safe energy; environment and sanitation; health; and participatory planning and decision-making. In addition, water and energy assessments (measuring the quality, quantity and accessibility of both resources), transect walks, in-depth interviews and focus group discussions were undertaken. These research methods were employed in tandem with stakeholder engagement processes. Importantly, deliberative sessions were held with community members to broaden the project's understanding of their challenges and open up space for them to suggest solutions to those challenges. The discussions in these sessions were also used to confirm and augment the results of the survey undertaken in the communities, making for a comprehensive analysis of the perceptions of the community members regarding their own challenges. Furthermore, water and energy resource assessment (quality, quantity and accessibility) was done. The energy resource assessment entailed sampling of human waste pit latrines, and determining the biogas potential (i.e. the maximum volume of biogas that can be obtained from a given amount of substrate); from this a biogas production plant model was developed. While water analysis entailed sampling both ground and surface water in the vicinity of the research sites, and conducting water quality analysis; and from this a suite of technologies for potable water production was recommended. Water quantity assessment was made using secondary data published by water authorities in the respective countries.

Results to date: The project findings made it clear that it would be inappropriate to prescribe a one-size-fits-all solution for water and energy access in the two project communities, given the variations in their nature and character. For Chambishi, which has ample access to fresh surface and ground water yet relies overwhelmingly on contaminated water from poorly constructed wells, the project found that solar-powered low-pressure filtration systems coupled with a disinfection step can be installed at the household level or in designated areas that are easily accessible by community members. In Diepsloot, on the other hand, where residents get potable water and sanitation services from the municipality at no cost but experience regular supply shortages, a biogas and/or solar-powered decentralized water system can be used to augment the existing municipal supply. In addition, Water reclamation from the nearby municipal wastewater works may present another sustainable, reliable

Diepsloot river.
Photo belongs to the project

and promising solution in this and similar townships in the future. While the community is amenable, in principle, to the use of reclaimed water (provided the water is deemed safe for reuse), further extensive public consultations will need to be done and care needs to be exercised in terms of implementation.

In the meantime, the project introduced Chambishi residents to interim measures such as building improved pit latrines and boiling or disinfecting water with bleach before drinking. The project also carried out sensitization on the recommended distance between pit latrines and water wells and the threat of water contamination posed by improperly managed solid waste, especially during the rainy season. Overall, the project proposed changes to the water and sanitation infrastructure and improved related practices and norms in Chambishi.

In Johannesburg, the project's findings were presented to the South African Local Government Association and the Provincial Mayoral Committee on Water, Sanitation and Environmental Management. This resulted in the research team being invited to work with local government authorities in developing a public awareness campaign on water, sanitation, hygiene and environmental management targeted at informal settlements in the city's surrounding Gauteng Province.

The following knowledge products have resulted from the project:

- Mwandila, G., Mwanza, M., Sikhwivhilu, K., Siame, J., Mutanga, S. S. and Simposya, A. 2021. Modeling energy requirements for a biogas-supported decentralized water treatment systems for communities in Chambishi (Zambia) and Diepsloot (South Africa) townships. *Renewable Energy Focus*, Vol. 37, pp. 20–26. https://doi.org/10.1016/j.ref.2021.02.003
- Sikhwivhilu, K., Mutanga, S. and Siame, J. 2020. *Understanding the 'water-energy-health' nexus in urban contexts in Africa: towards biogas-supported decentralized water treatment system for communities in Diepsloot (South Africa) and Chambishi (Zambia) townships*. Pretoria, Africa Institute of South Africa. ISBN: 978-0-7983-0480-1.
- Sikosana, M. L., Sikhwivhilu, K., Moutloali, R. and Madyira, D. M. 2019. Municipal wastewater treatment technologies: a review. *Procedia Manufacturing*, Vol. 35, pp. 1018–24. https://doi.org/10.1016/j.promfg.2019.06.051
- Sichilima, S., Siame, J., Sikhwivhilu, K., Mutanga, S. S., Mwandila, G., Maseka, K. K., Mukosha, L., Makhafola, M. and Simposya, A. 2017. Energy–water nexus in sub-Saharan Africa – Biogas-supported decentralised water treatment for urban communities: a case of Chambishi (Zambia) and Diepsloot (South Africa). Paper presented at the International Conference on Energy, Environment and Climate.

2

LIRA PROJECT

Mitigating risks from flood-related waterborne diseases in Abidjan (Côte d'Ivoire) and Lomé (Togo)

This project contributes to SDG 3, SDG 6 and SDG 11

This LIRA project (2017–2019), led by **Kouamé Parfait Koffi at the Swiss Centre for Scientific Research in Abidjan, Côte d'Ivoire**, aimed to identify mitigating measures related to the transmission of cholera and leptospirosis during flood events in Abidjan (Côte d'Ivoire) and Lomé (Togo). Climate change is contributing to the increased frequency and magnitude of flooding observed in recent years. The situation is particularly critical for urban settings in sub-Saharan Africa, where flooding is often associated with water pollution that derives from poor waste management which, in turn, facilitates the spread of infectious diseases. The combination of natural disasters, poor urban infrastructure and uncontrolled population expansion represents a major threat to human livelihoods and health in the region.

Against this background, the project in Abidjan and Lomé set out to achieve four objectives: to study the health status of at-risk populations; to document the burden of cholera and leptospirosis in those populations; to improve the management of flooding events and consequently lower the vulnerability of those affected; and to assess the response mechanisms that are critical for managing infections among at-risk populations during those events. Given the lack of relevant data in the study areas, the project employed a strategy that integrates human, animal and environmental health using the EcoHealth and One Health approaches. Crucially, the project generated knowledge that enabled the research team to make policy recommendations to local authorities that can help prevent cholera and leptospirosis outbreaks during flooding events in the future.

Expertise and partners involved: The project brought together four researchers based at the Swiss Centre for Scientific Research in Côte d'Ivoire and in Togo. These researchers were drawn from the fields of water and sanitation, sociology and epidemiology. The research team engaged with a wide range of stakeholders, including government ministries and agencies and non-governmental organizations (both local and international) working in the areas of public health, sanitation and disaster relief. The key stakeholders in Abidjan were the Ministry of Health, the Ministry of Environment and Sustainable Development, the Ministry of Infrastructure and Construction, the National Office for Civil Protection, the National Office for Sanitation and Drainage, the national meteorological agency SODEXAM, the municipalities of Abobo and Cocody, Red Cross, Children of Africa, N'CLO BAKAN, NADO and Eau et Vie. In Lomé, the main stakeholders were the Ministry of Health, the National Agency for Sanitation and Public Health, the Centre for Public Health Emergency Operations, the National Agency for Civil Protection and the municipality of Lomé.

Methods applied to deliver research: The methodological sequence of the project was as follows: the launch of research activities, data collection, stakeholder investigation, dissemination of research outcomes, and data management. The study began with a kick-off workshop in Abidjan and site visits involving researchers and stakeholders within the EcoHealth and One Health concepts.

Scientists from Centre suisse de Recherches Scientifiques en Côte d'Ivoire take water samples to test for cholera and leptospirosis while people wash their clothes, Abidjan, Côte d'Ivoire.
Photo: CMAPPING

The project applied a transdisciplinary framework using a qualitative approach comprising a desk review and key informant interviews with stakeholders, covering various issues related to flood risk. In addition, quantitative investigations (households surveys, laboratory analysis and geographical surveys) were conducted to assess the transmission patterns of flood-related waterborne diseases. In the Abobo and Cocody municipalities of Abidjan, a cross-sectional survey was conducted with 844 households. Overall, 200 samples of flood water were collected from households and drainage streams and analysed in the laboratory. The parameters analysed in the samples included water pH, dissolved oxygen and conductivity. *Giardia lamblia* and *Vibrio cholerae* spp. Concentrations were assessed using the sodium acetate formalin (SAF) method and the most probable number (MPN) method respectively. In all, 129 rodents (35 in Abobo and 94 in Cocody) belonging to three species – *Mus musculus*, *Crocidura* and *Rattus* – were captured from households. Blood was sampled from those rodents, followed by a polymerase chain reaction (PCR) analysis to detect *Leptospira* species.

Results to date: The study found, firstly, that all housing types in the project areas were at risk of contracting flood-related diseases. *Giardia lamblia* cysts were found in the flood water sample from Abobo municipality, but not in the one from Cocody municipality. There was no contamination by *Vibrio cholerae* of the flood water samples from both areas. There was no *Leptospira* spp. In the water, blood, and urine samples taken. However, waterborne pathogens associated with flood water were present, highlighting the risk of faecal contamination.

Secondly, the project results showed that flooding is a critical issue in the study areas, posing serious problems affecting human populations. Poor hygiene practices and contact with contaminated water are main causes of infection. Little collaboration exists between the stakeholders involved in flood response efforts, limiting the efficiency of planned interventions. The capacity for a coordinated response is further

weakened by a lack of policies for health risk prevention during flooding events. Compounding the problem is the limited access to land in the project areas, which makes it is difficult for stakeholders to make advance plans for sheltering displaced flood victims.

The project has published the following article:

- Kouamé, P. K., Fokou, G., Koffi, A. J. D., Sani, A., Bonfoh, B. and Dongo, K. 2022. Assessing institutional stakeholders' perception and limitations on coping strategies in flooding risk management in West Africa. *International Journal of Environmental Research and Public Health*. Vol. 19, No. 11, 6933. https://doi.org/10.3390/ijerph19116933

The project has two other articles under review:

- Kouamé, P. K., Dongo, K., Fokou, G., Apkatou, B., Ouattara, A. F. and Bassirou, B. Forthcoming. Assessing transmission patterns of flood-related waterborne diseases in two urban municipalities of Côte d'Ivoire. *Urban Ecosystems*. Preprint available at https://doi.org/10.21203/rs.3.rs-2048605/v1
- Kouamé, P. K., Bai, S., Leitao, J. P., Yao, B. K., Sherif, A., Jetten, V. and Lüthi, C. Forthcoming. Flooding related-risks assessment using OpenLISEM modeling approach in two urban municipalities of Côte d'Ivoire.

3

LIRA PROJECT

Assessment and characterization of volcanic and flood hazards and their health implications in Goma (Democratic Republic of Congo), Buea and Limbe (Cameroon)

This project contributes to SDG 3 and SDG 11

This LIRA project (2017–2019), led by Mabel Nechia Wantim from the University of Buea, Cameroon, seeks to assess the risks of natural disasters such as volcanic earthquakes and floods in Goma (Democratic Republic of Congo), Buea and Limbe (Cameroon), as well as the health implications of these hazards, in an attempt to reduce risks to the cities' vulnerable populations.

Goma, Limbe and Buea are all significant urban areas located within active volcanic centres on the African continent. Goma is situated at the flanks of Mount Nyiragongo – the second most active volcano in the East African Rift System. And Limbe and Buea are found at the flanks of Mount Cameroon – the most active volcano along the Cameroon Volcanic Line. Millions of people have been affected by lava flows, toxic gas emissions, landslides, floods, and eruptions due to volcanic activity in these regions in the past, and have faced enforced evacuation, starvation, disease, damage to the local environment, and social and economic disruption.

Expertise and partners involved: The project brings together the University of Buea, Cameroon; the Goma Volcano Observatory (OVG), DR Congo; the Buea Council; Limbe City Council; Goma Municipal Council; traditional rulers in Limbe; media (Cameroon and Goma); religious leaders; the Ministry of Health in Cameroon; and the communities (indigenous and migrant) in Buea and Limbe. During the project proposal development stage, the PI brought together relevant policy-makers and communities to define research questions that reflected community needs. This process also helped to strengthen the project's ownership by communities and policy-makers. For instance, the Universities of Buea and the Goma Volcano Observatory (OVG) decided to provide office and laboratory space and equipment to project members to carry out their research. The City Councils provided human resources to support the implementation of activities aimed at flood management in the cities. They also provided the venues for the project workshops. Health authorities facilitated collection of hospital data needed for the study.

Methods: To evaluate the effects, perceived risk, and coping strategies of people exposed to volcanic activities and floods in the three cities, the LIRA project initiated the development of a database of these hazards. The data was collected through questionnaires, semi-structured interviews, hospital data and focus group discussions in these three cities for selected major past eruptions. The data collected comprised both scientific and indigenous knowledge. The other set of questionnaires focused on the effectiveness of preparedness and response strategies that have been put in place by the City Councils in these cities to mitigate the impacts of natural disasters.

Building on the findings of these surveys, the project organized a series of capacity building workshops with vulnerable populations in the three cities to raise awareness on the health impacts of natural hazards, to learn about existing local coping strategies and to discuss how these strategies can be improved to minimize the health impacts. Local communities, representatives of municipalities, health personnel,

academics, local chiefs and media attended these workshops. Following these training workshops, the City Councils and community chiefs agreed to sensitize further populations to the flood and volcano risks and coping strategies.

One of the key project learnings is that people's perception of hazards is strongly tied to indigenous knowledge and that this needs to be taken into account when developing coping strategies. For instance, the indigenous people believe that volcanic eruptions are mystical and are spurred by spirits or 'gods' when they get angry. However, integrating indigenous knowledge is challenging for scientists. In this process, power dynamics need to be dealt with carefully. For instance, the traditional rulers complained that the City of Limbe undermined their authority by instructing the communities in the case of a disaster to follow the recommendations of the government-appointed person and not to listen to the rulers. Engaging media should also be done carefully. Following the workshop in Limbe, a newspaper article was published with a title 'Experts warn of possible volcanic eruption in 2020.'

Results to date

Despite the challenges, this project has resulted in increased awareness among the affected communities of natural disasters and their health-related impacts; improved relationships between policy-makers, communities and researchers; and capacity building of Masters students – three Masters theses have been defended. In 2019 the project, together with engineers, architects, seismologists, mayors and traditional rulers, developed an official building code for the earthquake-prone region of Mount Cameroon, based on analysis of the intensities of historic volcanic earthquakes.

Researchers' skills in monitoring precursory volcanic activity were strengthened through participation in international training courses. The PI was also invited to attend several UN conferences on Disaster Risk Reduction.

The project has published the following article:

- Wantim, M. N., Fon Peter, N., Eyong, N. J., Zisuh, A. F., Yannah, M., Lyonga, M. R., Yenshu, E. V. and Ayonghe, S. N. 2022. Flood Hazard and Its Associated Health Impacts in Limbe Health District, Cameroon. *African Journal of Health Sciences*. Vol. 35, No. 4 (2022).

Mabel Nechia Wantim at the eruption site during a capacity building training in Hawaii. Photo belongs to the project

4

LIRA PROJECT

Bringing clean energy to informal settlements: Co-designing sustainable energy solutions in Kenya, Uganda and South Africa

This project contributes to SDG 3, SDG 7, and SDG 11

Providing clean energy to urban informal settlements in Africa is a huge challenge. This LIRA project (2017–2019), led by **Amollo Ambole from the University of Nairobi in Kenya**, sought to provide integrated solutions to the household energy challenge and its related health outcomes in urban informal settlements in Kenya, Uganda and South Africa.

Expertise and partners involved: The research team brought together expertise from design thinking and social innovation; urban metabolism and renewable energy; urban sociology and gender mainstreaming; mechanical engineering; GIS mapping; and urban planning. The project engaged in research activities with various stakeholders in three countries. In Kenya, these were the University of Nairobi, National Ministry of Energy, Kenya Power company, Nairobi County Council and community members from Mathare; in South Africa, Stellenbosch University, Stellenbosch Municipality and community members from Enkanini; and in Uganda, Makerere University, Kampala National Planning Authority and community members from Kasubi-Kawaala informal settlements. Development and funding agencies also took part including UNEP-South Africa, IDRC-Kenya, IRD-Kenya, SHOFCO and Slum Dwellers International.

This variety of academic disciplines and expertise required the research team to continuously seek a shared understanding of the complex challenge involved. This shared understanding was shaped by the realities of the informal settlement case studies. For instance, the researchers had to learn how informal energy service provision networks and existing mobilization channels were organized.

Methods: To gain an in-depth understanding of the energy-health nexus challenge in the case studies, the researchers worked with informal settlement dwellers as community co-researchers through:

- Household surveys of 100 households in Mathare Valley informal settlement (Nairobi, Kenya) and Kasubi-Kawaala informal settlement (Kampala, Uganda), focusing on household energy access and use and their implications for housing, work and health issues. For comparative purposes, the survey instrument was similar in both cases, and was informed by a previous study in Enkanini informal settlement (Stellenbosch, South Africa). However, the researchers in each case engaged community co-researchers in inception workshops to contextualize the instrument.
- Participatory mapping exercises with Mathare and Kasubi-Kawaala community members focusing on energy access.

Using results from the fieldwork, the research engaged additional stakeholders, including experts from the private sector and policy. These broader stakeholder interactions took place through co-design workshops and policy seminars in each country. In addition, the researchers from the three countries came together for a regional workshop in Nairobi to carry out a comparative analysis of the three case studies.

The main challenge that the researchers faced during the project was difficulty in securing the participation of stakeholders from the private sector, in particular from the energy sector, since the researchers did not previously have extensive private sector contacts. On the other hand, the researchers were able to engage closely with informal settlement dwellers as co-researchers due to their prior research experience in the informal settlement case studies. The downside of overreliance on existing networks was that it unintentionally led to a situation where the same group of participants attended most of the research activities, preventing a more balanced representation during the research process.

Engaging stakeholders also required strong attention to ethical considerations. For instance, the community co-researchers had high expectations that the research would deliver immediate benefits. The researchers had to manage these expectations by making it clear that the research aimed at generating knowledge useful for identifying long-term solutions. In some cases, researchers had to use translations where participants did not understand technical terms or academic language. For example, some terms such as transdisciplinarity had to be described at length in Swahili in Nairobi and in Luganda in Kampala.

Results to date: From these multiple engagements, the project has proposed improved design and policy frameworks that would enhance national energy goals in the three countries, as well as contributing to the SDGs on health and wellbeing, gender equality, affordable and clean energy, and sustainable cities and communities. More specifically, the team proposed community driven innovation centres that would showcase suitable alternative technologies and provide a co-design space for stakeholders. In the Kenyan case study, the project proposed a product–service–system model for promoting alternative technology adoption in the settlement, through affordable business services such as pay-per-use or shared services. In the Ugandan case study, the team proposed a business model that would enhance the use of community-produced briquettes and articulated a more efficient supply and distribution of briquettes within the community.

Project site visit, Nairobi, Kenya.
Photo belongs to the project

This integration was crucial in tackling the complexity of the energy-health challenge in the informal settlements. Specifically, community members appreciated the opportunity to voice their concerns to the policy actors. The experts and policy actors for their part used the engagements to articulate their positions. The researchers thus acted as mediators by integrating these concerns and positions to arrive at the proposed solutions.

The transdisciplinary approach required significant time and was intellectually challenging for the researchers. The two-year timeline of the LIRA study was insufficient for achieving tangible results such as behavioural change, technological advancement or policy development. The researchers thus sought additional funding to continue with their work, having concluded that the transdisciplinary approach is more appropriate in a long-term research partnership. The project leveraged additional funding for policy work from the International Development Research Centre. Stellenbosch University supported the project with a two-year Post-doctoral Fellowship and project team mobility exchange.

To date, the project has produced the following knowledge products:

- Ambole, A., Musango, J. K., Buyana, K., Ogot, M., Anditi, C., Mwau, B., Kovacic, Z., Smit, S., Lwasa, S., Nsangi, G., Sseviiri, H. and Brent, A. C. 2019. Mediating household energy transitions through co-design in urban Kenya, Uganda and South Africa. *Energy Research & Social Science*, Vol. 55, pp. 208–17. https://doi.org/10.1016/j.erss.2019.05.009
- Kovacic, Z., Musango, J. K., Ambole, L. A., Buyana, K., Smit, S., Anditi, C., Mwau, B., Ogot, M., Lwasa, S., Brent, A. C., Nsangi, G. and Sseviiri, H. 2019. Interrogating differences: a comparative analysis of Africa's informal settlements. *World Development*, Vol. 122, pp. 614–27. https://doi.org/10.1016/j.worlddev.2019.06.026
- Ambole, A., Koranteng, K., Njoroge, P. and Luhangala, D. L. 2021. A review of energy communities in sub-Saharan Africa as a transition pathway to energy democracy. *Sustainability*, Vol. 13, No. 4. https://doi.org/10.3390/su13042128
- Policy brief: *Mediating household energy–health–gender nexus transition through co-design and policy integration in urban Africa.*

In addition, the PI has presented the project results at several international fora, including: the UN Science Technology and Innovation Fora on Sustainable Development in 2018 and 2019 in New York; the Seedbeds of Transformation, 2018 in Port Elizabeth; the first UN-Habitat Assembly, 2019 in Nairobi; the Gates Grand Challenges annual meeting in Addis Ababa, Oct 2019, and the EVERYDAY design residency for energy stakeholders organized by Edinburgh University in Arusha in 2019. Furthermore, as a result of the transdisciplinary nature of the LIRA project, the PI was awarded a Rutherford fellowship by Leicester Institute of Advanced Studies, at the University of Leicester, UK.

Building on the LIRA project, the Kenya and South Africa project partners jointly applied for the Africa-UK trilateral research chair to further study the gendered dimension of energy innovation and explore commercialization opportunities for affordable energy technologies and services. In July 2019, the partners were awarded a five-year grant to collaborate with Brunel University as the UK partner. Going forward, the new collaborative team intends to establish the proposed innovation centres in the form of living labs in Kenya and South Africa to co-design gendered innovations and explore commercialization opportunities in alternative energy technology and services.

5

LIRA PROJECT

Citizen science for improved air quality in Nairobi and Addis Ababa

This project contributes to SDG 3, SDG 7 and SDG 11

This LIRA project (2017–2019), led by **Philip Osano from Stockholm Environment Institute in Kenya**, seeks to identify and increase awareness of air pollution hotspots in Nairobi, Kenya, and Addis Ababa, Ethiopia, through citizen science. The project contributes to national air quality, health and energy development priorities in Kenya and Ethiopia, as well as to the SDGs 3 on health, 7 on clean energy and 11 on cities and human settlements.

A team of early career researchers from Nairobi, Kenya, and Addis Ababa, Ethiopia, are investigating whether citizen science – in which non-scientists and amateurs participate in research – can help to identify solutions for improved air quality in Mukuru, the third largest informal settlement in Nairobi. With a population of more than 100,000 squeezed into just 260 ha of land, Mukuru's community faces challenges similar to those faced in many informal settlements: extreme overcrowding, and poor sanitation and water services. The air quality has worsened over the years, but there is little or no information on the scale of the problem and its impact on the inhabitants of the area.

Expertise and partners involved: In order to get a deeper understanding of this complex problem, a team of researchers and practitioners from the Stockholm Environment Institute Africa (SEI), APHRC (African Population and Health Research Center), the University of Nairobi, Slum Dwellers International Kenyan Chapter, and the Horn of Africa Regional Centre and Network in Ethiopia work with the communities to co-produce knowledge that will respond to the communities' and policy-makers' needs to address air pollution in Nairobi and Addis Ababa. These researchers have trained some residents and given them portable particulate matter sensors to assess their exposure to both indoor and outdoor air pollution.

Besides moving around with the portable sensors, the trained community members participated in focus group discussions and qualitative interviews through household surveys, in order to better understand indoor and outdoor air pollution and their health impacts. In the process, these community members are also sharing information with fellow residents, and with policy-makers in Nairobi and Addis Ababa. They are also raising awareness of the potential health impacts of air pollution. Some of the citizen scientists are community health workers – people from the community, mostly women, who have been trained as paramedics by the Ministry of Health to assist with health outreach services among local residents. These workers are now helping to educate others on how to avoid being exposed to air pollution. This forms part of their routine health education visits to families, through a programme funded by the Health Departments.

The involvement of community members, policy-makers, industry groups (such as the Kenya Association of Manufacturers), and civic associations (such as the Kenya Alliance of Residents Association and the 100 Resilient Cities Network in Addis Ababa) facilitates the framing of relevant solutions. Alongside practical actions to reduce exposure, knowing more about the sources and risks of pollution has enabled

the community to speak up about air pollution. Denis Waweru, one of the research community members involved in project implementation in Mukuru, won the national photography competition organized by the National Environment Management Authority to mark the 2019 World Environment Day celebration.

However, engagement with different stakeholders can be a challenging process, especially when managing stakeholders' expectations. The key lesson the team has learned is that it is important to understand the incentives for communities, industry and regulatory authorities to be part of the research process, and to be honest with them about the project boundaries. It is also important to be prepared to manage conflicts at different levels (e.g. between community and industry, between institutions with overlapping mandates, between sub-national and national agencies). Another challenge is to coordinate with other ongoing projects and programmes for increased impact. It is important to take advantage of windows of opportunity, especially in policy, and this requires flexibility and skills to build new alliances.

Results to date: For the research team the involvement of different interest groups, while challenging, has already helped to generate interest in their findings. The results of the particulate matter measurements have been included in the status report for the Nairobi City County's Mukuru Special Planning Area project. The research and practitioner teams are also involved in the preparation of the Air Quality Policy and Air Quality Action Plan for Nairobi City, which is being developed by the Nairobi City County Government, besides contributing to national air quality management plans and to the air quality assessment for health and environment policies in Ethiopia coordinated by the United Nations Environment Programme.

Jointly with the Ministry of Environment and Forestry and the Kenya Medical Research Institute, the project co-hosted the Health, Environment and Climate Change Conference in December 2019, raising awareness of integrated planning for air pollution and climate change. The project also organized a Nairobi air pollution roundtable in 2019, focused on sharing existing science and policy and exploring future collaboration to combat air pollution in the region. In 2019, the project team organized capacity building training on air quality management for 30 environment and health technical officers from the Nairobi City County Government.

The project was represented at the United Nations Environment Assembly in 2017 and 2019 and at Sida Science Day in 2019. The project has also developed a blog and videos to raise awareness on the pollution challenges (see 'Unchecked Injustice' and 'Nyongwa: Smoke chokes'). Two newspaper articles about research were published in the Daily Nation.

In 2020, project team members sensitized 40 Nairobi City County Assembly parliamentarians on the draft air quality policy for the county, and the draft air quality action plan during the Nairobi City County Assembly Sensitization Workshop on The Draft Air Quality Policy held in October 2020 in Mombasa, Kenya.

The project has contributed to the development of the following knowledge products:

- Opiyo, R., Osano, P., Mbandi, A., Apondo, W. and Muhoza, C. 2020. Using citizen science to assess cumulative risk from air and other pollution sources in informal settlements. *Clean Air Journal*, Vol. 30, No. 1. https://doi.org/10.17159/caj/2020/30/1.8374
- Sessional Paper No. 2 of 2020 on Nairobi City County Air Quality Policy

The following manuscripts have been developed:

- Draft manuscript on the policy coherence analysis for air pollution, energy and health nexus in Kenya
- Draft manuscript on community perception of air pollution and health impacts
- Draft manuscript being prepared for the policy coherence analysis for air pollution, energy and health nexus in Ethiopia

6

LIRA PROJECT

Towards reducing human exposure to combustion-derived pollutants in urban areas of the Lake Victoria watershed, Kampala (Uganda) and Mwanza (Tanzania)

This project contributes to SDG 1, SDG 3, SDG 7, SDG 11

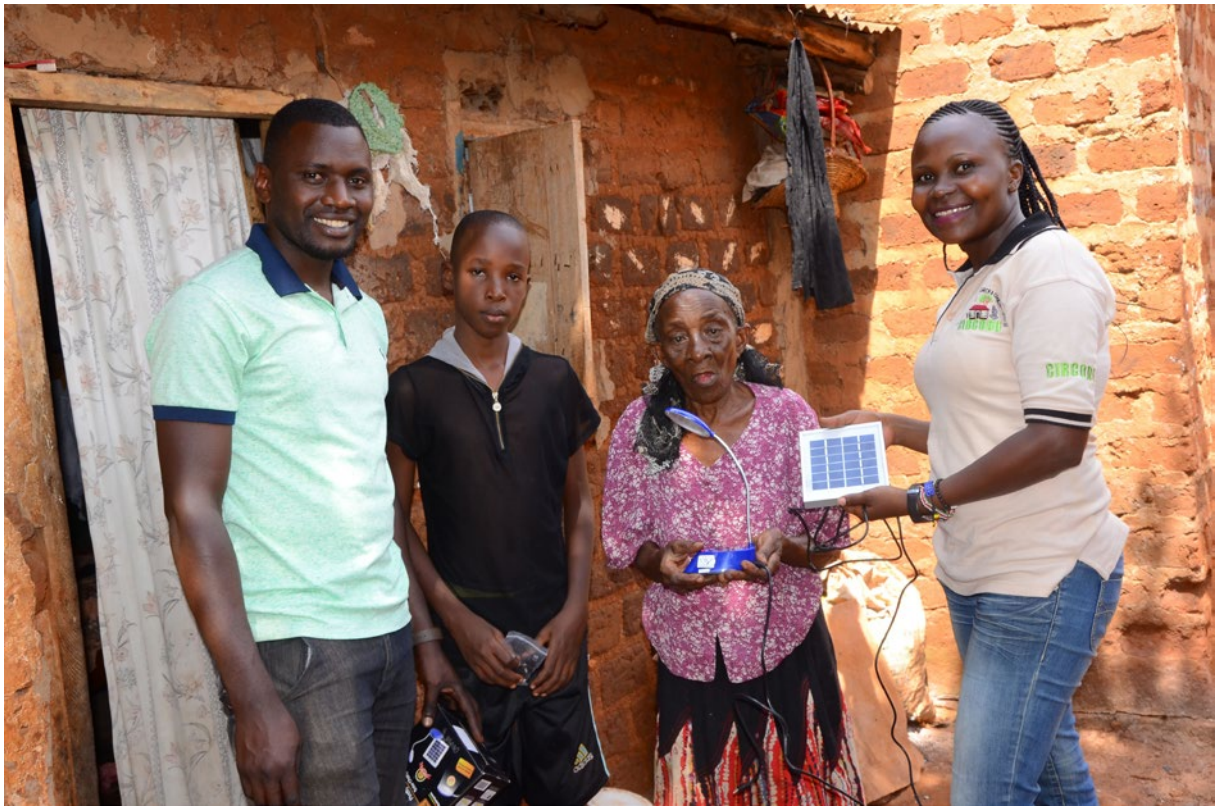
This LIRA project (2017–2019), led by **Kenneth Arinaitwe at Makerere University, Uganda**, investigated the reduction of indoor air pollution in households in Kampala and Mwanza following their adoption of improved cooking and lighting technologies. Indoor levels of particulate matter and carbon monoxide were monitored along with energy use (for cooking and lighting) using real-time data loggers. A portable chimney design was developed and piloted to investigate possible further reduction in indoor pollution, given space limitations in the target households and the technological limitations of improved cookstoves. These technical interventions were complemented by stakeholder engagement in the project communities, which enabled households to understand their contribution to the indoor air pollution problem and their potential role in its resolution.

Specifically, the project aimed to address the following questions:

1. What is the extent of communities' knowledge and appreciation of combustion-derived pollution?
2. What are the underlying intra-community thought processes that influence the current practices that have a bearing on indoor air quality?
3. How severe are the barriers to adoption of improved cooking and lighting technologies faced by households, and what impact do these have on communities?
4. How best can researchers work with communities to demonstrate and quantify improvements in indoor air quality following adoption of improved cooking and lighting technologies and best practices?
5. How do project activities influence stakeholders' attitudes and perception of combustion-source pollution, particularly in indoor environments and with respect to the use of improved cooking and lighting technologies?

Expertise and partners involved: The project brought together twelve academics and practitioners (two senior researchers, six field research assistants, one field research coordinator, one technical assistant and two technical advisors) based at Makerere University, the Centre for Integrated Research and Community Development, Uganda. The researchers were drawn from the fields of environmental health sciences, public health, mechanical engineering, sociology and economics.

Methods applied to deliver research: The project used a combination of qualitative and quantitative research methods. The main qualitative methods used were key informant interviews and focus group discussions. Household visits, community meetings, photography and video were also used to stimulate engagement and capture important details. Quantitative data were gathered through real-time measurement of particulate matter, carbon monoxide and stove temperature using portable logging



Dissemination of improved lighting technologies at project site.
Photo belongs to the project

sensors. Measurement of particulate matter was also done geometrically. The resulting data were analysed using statistical methods.

Results to date: The project enabled participants at the community level to demonstrate awareness and appreciation of the pollution problem associated with their energy usage and indoor heating habits. The process helped households to understand the causes and effects of invisible pollutants such as carbon monoxide as well as alternative behaviours and technologies they could adopt to reduce the pollution footprint of their energy use. The project also designed, developed and piloted a portable solar-powered chimney, which enabled further improvements in indoor air quality beyond those enabled by improved charcoal cookstoves and portable solar lights (the latter being replacements for kerosene lamps). The team is working towards publication of the research results in academic journals.

Cohort 2

7

LIRA PROJECT

Transforming Durban (South Africa) and Harare (Zimbabwe) in a changing climate

This project contributes to SDG 11 and SDG 13

Current, conventional adaptation agendas often take a narrow view of tackling climate risks and impacts. They operate within the current state of the socio-ecological system, not questioning the unsustainable or unjust aspects of this system. A transformative approach to adaptation has now emerged, which recognizes the need to deal with the synergistic effects of climate change together with other drivers of risk and global change. This approach links such issues as justice, equality and inclusivity with the climate change agenda, and tries to address the root causes of societal vulnerabilities.

Using Durban (South Africa) and Harare (Zimbabwe) as case studies, this LIRA project (2018–2020), led by **Alice McClure from the University of Cape Town, South Africa**, seeks to better understand the potential of transformational adaptation in managing climate-related water risks through engagement with stakeholders.

The project draws on literature and concepts associated with climate change adaptation, transformation and transdisciplinarity. It aims to make a theoretical contribution to academic work and a practical contribution to decision-making in southern African cities by analysing data collected during transdisciplinary engagements, semi-structured interviews with a range of stakeholders and document analysis.

Expertise and partners involved: The project brings together multiple actors and types of expertise, including participants from water management, urban resilience, development studies, environmental anthropology, collaborative ethnography, urban climate adaptation, human geography, wetlands management and environmental management. EThekwini Environmental Planning and Climate Protection Department, eThekwini Water and Sanitation, GIZ, Zimbabwe National Water Authority and the City of Harare are key project partners.

Methods: Scientists and practitioners meet in carefully facilitated creative workshops called 'learning labs'. These labs provide a space to co-explore characteristics of transformational adaptation; select adaptation cases in Durban and Harare that showcase transformative characteristics; collectively assess their appropriateness to each city; and investigate how the theoretical ideas of transformational adaptation can be applied in southern African cities, unpacking the barriers, challenges and opportunities associated with implementing interventions that have transformative characteristics within these local contexts.

In Durban, the 'Sihlanzimvelo' programme was identified as a case study with transformative characteristics, because it seeks to reduce climate risks through improving the ecological infrastructure of watercourses,

while simultaneously supporting the development of small – to medium-sized businesses in the most vulnerable communities. The LIRA project assessed the transformational adaptation potential of the Sihlanzimvelo programme in the context of the socio-economic objectives of Durban. The research team engaged with stakeholders at different levels of this programme (e.g. business co-ops, project implementors, project managers and visionaries) through learning labs, meetings, focus groups and interviews to understand *inter alia*:

- How the case compares with theoretical concepts of transformational adaptation
- Pathways towards the transformative approach adopted
- Trade-offs that have been or will be made when working towards transformation
- Ways in which the case could be more transformative.

Similar activities were planned to take place in Harare. However, due to the political context, fewer labs have been organized in Harare. Despite this, two case studies have been selected – Harare Wetlands Advocacy Project and the Urban Resilience project. Given the political context in Harare, the project had to shift its focus on stronger cross-city exchanges and learning, leading to participants from Harare taking part in the learning labs in Durban.

Results to date: The project generated knowledge about the potential effects of climate change on frequency of floods in Durban, as well as responses to these; the benefits of ecosystems for reducing impacts of floods; and ways in which small – to medium – sized businesses can be linked to river ecosystems to promote river health and increase income for local communities. Through the learning labs, the project also developed the principles of transformative adaptation:

Alice McClure at the Future Earth Seedbeds of Transformation, South Africa.
Photo: Future Earth

- Fundamental changes in thinking and doing
- Inclusive
- Challenges power asymmetries
- Must be demonstrable in practice
- Responsive and flexible
- Holistic, complex systems thinking
- Sustainable.

These principles were integrated into the planning for the Transformative River Management Programme in Durban, which is ongoing. Based on these principles, an ecological infrastructure and socio-ecological toolkit was developed to support transformative adaptation of rivers in an urban context.

In Harare, as a result of the project activities in combination with other academic projects focused on climate change, a Climate Change desk has been established within the municipality.

The project also did a regional comparison and collated transferable lessons that will support the scaling up of TA within and between other African cities. Apart from producing context-specific knowledge on TA, the project also provided critical feedback to the TA literature based on practical experiences and on evidence that is being generated by interventions that are working towards transformation in these cities.

The project documentary, *Changing Course: A look into transformative river management in Durban*, has been presented at the Better Cities Film Fest in April 2021. It was also used at the launch of Durban's Climate Adaptation Plan in 2019.

To date, the project has contributed to the development of the following knowledge products:

- O'Farrell, P., Anderson, P., Culwick, C., Currie, P., Kavonic, J., McClure, A., Ngenda, G., Sinnott, E., Sitas, N., Washbourne, C., Audouin, M., Blanchard, R., Egoh, B., Goodness, J., Kotzee, I., Sanya, T., Stafford, W. and Wong, G. 2019. Towards resilient African cities: shared challenges and opportunities towards the retention and maintenance of ecological infrastructure. *Global Sustainability*, Vol. 2. https://doi.org/10.1017/sus.2019.16
- Pretorius, L., Taylor, A., Lipinge, K., Mwalukanga, B., Mucavele, H., Mamombe, R., Zenda, S. and McClure, A. Forthcoming. Knowledge intermediaries for urban climate adaptation: an embedded researcher approach in southern African cities. *Environment and Urbanization.*
- Kareem, B., McClure, A., Walubwa, J., Koranteng, K., Mukwaya, P. I. and Taylor, A. 2022. Power dynamics in transdisciplinary research for sustainable urban transitions. *Environmental Science & Policy*, Vol. 131, pp. 135–42. https://doi.org/10.1016/j.envsci.2022.02.001
- Thondhlana, G., Mubaya, C. P., McClure, A., Amaka-Otchere, A.B.K. and Ruwanza, S. 2021. Facilitating urban sustainability through transdisciplinary (TD) research: lessons from Ghana, South Africa, and Zimbabwe. *Sustainability*, Vol. 13. https://doi.org/10.3390/su13116205
- McClure, A. and Ziervogel, G. 2018. How African cities' residents are creating climate change solutions. *The Conversation Africa*. https://theconversation.com/how-african-cities-residents-are-creating-climate-change-solutions-98487
- Policy brief: *Pathways to transformative climate adaptation in southern African cities*

8

LIRA PROJECT

Making global SDG indicators relevant to local communities in Kampala (Uganda) and Nairobi (Kenya)

This project contributes to SDG1, SDG 2, SDG 3, SDG 7, SDG 8, SDG 11, and SDG 13

This LIRA project (2018–2020), led **by Kareem Buyana at Makerere University, Uganda**, focuses on scaling up the transformation of organic waste into energy briquettes as alternative cooking fuel for households. The project also works with the local briquette-making enterprise, communities and urban policy actors in Kampala and Nairobi to come up with appropriate SDGs indicators that fit into the local context. The project takes place in Bwaise III parish in Kampala, Uganda and Kahawa Soweto Kibera in Nairobi, Kenya. These are two informal urban settlements where low-income groups extract and add value to materials from the waste stream through the use of organic waste for nutrient recovery and production of energy briquettes.

Expertise and partners involved: This project brings together academic and non-academic actors. The academics include experts in urban sociology, geography, fine art, photography, community studies, and spatial planning from Makerere University and the University of Nairobi. The non-academic participants include policy actors from Nairobi and Kampala City Authorities, as well as local community groups: Kasubi Local Community Development Association in Kampala and Kahawa Soweto Youth Club in Nairobi.

Methods: The process of making the SDGs, specifically SDG 11 on cities and SDG 7 on energy, relevant to local communities started by establishing SDG studios in each city. Organized as seminar workshops, these studios brought together local community groups and policy actors to translate SDGs through visuals and storylines depicting local context. The SDG studios enabled the stakeholders to discuss meanings and interpretations of the images and storylines, and to share experiences and ideas in the context of SDG implementation. This approach helped to mediate discourse on the integrated nature of the SDGs, while highlighting the (dis)connections between local and global measurements of sustainability in cities. This discussion with the communities and policy-makers led to the number of SDGs in consideration growing from two (SDG 11 and 7) to six, including: SDG 1 (no poverty), SDG 2 (zero hunger), SDG 3 (good health), SDG 7 (clean energy), SDG 11 (sustainable cities), and SDG 13 (climate action). Locally appropriate indicators for these SDGs were jointly selected to align with local sustainability challenges and actions taken so far by the municipal authorities and local community groups.

Results to date: After completing the SDG studios, the academics worked with policy actors from Kampala Capital City Authority and Nairobi City County to develop a five-step process for the local applications of SDGs. The five steps include:

1. Categorize or group applicable and inapplicable indicators
2. Assess revisions required, based on the original intent of the indicator

3. Revise, replace or alter the indicator language as locally appropriate
4. Develop new indicators to align with local context
5. Validate mapped proposed indicators to existing local and scalable solutions in the community.

These five steps were useful in prioritizing and relating the SDGs to indicators that speak to local contexts and to the experiences of local community groups.

Makerere University and the University of Nairobi, together with the local community groups, are planning to use the locally developed SDG indicators to assess the quality of services (e.g. roads, water, electricity, health, housing, security) provided to these communities.

The project also cultivated ties with the United Nations Economic Commission for Africa, the National Planning Authority, and the Ministry of Lands, Housing and Urban Development in Uganda to mainstream SDG 11 and the New Urban Agenda into the National Development Plan III (2020–2025) of the Republic of Uganda. The project contributed to the design of the Sustainable Housing and Urban Development Programme as a core component of the National Development Plan III.

The project efforts have also resulted into the following scientific articles:

- Buyana, K. 2019. Keeping the doors open: experimenting science–policy–practice interfaces in Africa for sustainable urban development. *Journal of Housing and the Built Environment*, Vol. 35, pp. 539–54. https://doi.org/10.1007/s10901-019-09699-3
- Buyana, K., Lwasa, S. and Kasaija, P. 2019. Gender ideologies and climate risk: how is the connection linked to sustainability in an African city? *International Journal of Social Ecology and Sustainable Development*, Vol. 10, No. 1, pp. 16–30. https://doi.org/10.4018/IJSESD.2019010102

SDG studios with local communities, Kampala, Uganda.
Photo belongs to the project

- Buyana, K., Byarugaba, D., Sseviiri, H., Nsangi, G. and Kasaija, P. 2019. Experimentation in an African neighborhood: reflections for transitions to sustainable energy in cities. *Urban Forum*, Vol. 30, No. 2, pp. 191–204. https://doi.org/10.1007/s12132-018-9358-z
- Buyana, K., Lwasa, S., Tugume, D., Mukwaya, P., Walubwa, J., Owuor, S., Kasaija, P., Sseviiri, H., Nsangi, G. and Byarugaba, D. 2020. Pathways for resilience to climate change in African cities. *Environmental Research Letters*, Vol. 15, No. 7. https://doi.org/10.1088/1748-9326/ab7951
- Kovacic, Z., Musango, J. K., Buyana, K., Ambole, A., Smit, S., Ml, B., ... and Brent, A. (2021). Building capacity towards what? Proposing a framework for the analysis of energy transition governance in the context of urban informality in Sub-Saharan Africa. *Local Environment*, Vol. 26, No. 3, pp. 364–78. https://doi.org/10.1080/13549839.2020.1849075
- Kovacic, Z., Musango, J. K., Ambole, L. A., Buyana, K., Smit, S., Anditi, C., Mwau, B., Ogot, M., Lwasa, S., Brent, A. C., Nsangi, G. and Sseviiri, H. 2019. Interrogating differences: a comparative analysis of Africa's informal settlements. *World Development*, Vol. 122, pp. 614–27. https://doi.org/10.1016/j.worlddev.2019.06.026
- Buyana, K., Walubwa, J., Mukwaya, P. et al. 2021. City residents, scientists and policy-makers: power in co-producing knowledge. *Urban Transformations*, Vol. 3, No. 1. https://doi.org/10.1186/s42854-021-00020-6
- Buyana, K. 2021. Do global pandemics disrupt or seed transformations in cities? A systematic review of evidence. *Social Sciences & Humanities Open*, Vol. 4, No. 1. https://doi.org/10.1016/j.ssaho.2021.100138.
- Kareem, B., McClure, A., Walubwa, J., Koranteng, K., Mukwaya, P. I. and Taylor, A. 2022. Power dynamics in transdisciplinary research for sustainable urban transitions. *Environmental Science & Policy*, Vol. 131, pp. 135–42. https://doi.org/10.1016/j.envsci.2022.02.001
- Buyana, K. 2022. Transgression in the energy infrastructure landscapes of cities. *Landscape Research*, 1–13. https://doi.org/10.1080/01426397.2022.2039108
- Buyana, K., Walubwa, J.J.A., Mukwaya, P., Sseviiri, H., Byarugaba, D. and Nakyagaba, G.N. 2022. Global norms, African contexts: a framework for localizing SDGs in cities. Croese, S., Parnell, S. (eds), *Localizing the SDGs in African Cities*. Sustainable Development Goals Series. Cham, Springer. https://doi.org/10.1007/978-3-030-95979-1_3

In 2019, the PI presented his research at the Shanghai Conference at the College of Architecture and Urban Planning, Tongji University, China; the UN High-level Political Forum on SDGs, New York; the 2019 Gwendolen M. Carter Conference at University of Florida (Center for African Studies); and the Annual Science Forum in South Africa.

9

LIRA PROJECT

Realizing the potential of urban density to create more prosperous and liveable informal settlements in Durban (South Africa) and Luanda (Angola)

This project contributes to SDG 11

This LIRA project (2018–2020), led by **Justin Visage from Human Science Research Council, South Africa**, seeks to generate knowledge for improving the quality of life in dense informal settlements in South Africa (Durban) and Angola (Luanda) through a coordinated plan of building housing upwards. A weakness of many existing upgrading programmes is that they focus narrowly on extending basic services and ignore the structural limitations of the current built form, including a lack of living space, inadequate streets for circulation, insufficient shared public spaces and a lack of facilities for micro-enterprises or public services. African cities need to find ways to develop upwards rather than outwards, achieving a compact urban form in order to economize on land, improve connectivity, and make room for scale on infrastructure delivery.

Expertise and partners involved: The project has benefited from involvement of a wide range of stakeholders throughout the research life-cycle, from research design through to research co-production, which is currently in progress. The project brings together a transdisciplinary team of academics and practitioners from the Human Science Research Council, Development Workshop Angola, and Project Preparation Trust, eThekwini Municipality, including urban planners, economists, architects, project managers in construction and community-based planners.

Methods: Through a conceptual-framing workshop, the project brought together a diversity of stakeholders from local and national spheres of government, academics, practitioners, and NGOs and community-based organizations to share their insights and experiences of managing rapid informal densification. The workshop made use of online polling (i.e. real-time interactive audience participation) to capture a variety of perspectives and gauge levels of support. Smaller breakaway discussion groups were used to brainstorm core themes. There were evident tensions in the objectives of different stakeholder groups, for example between accessibility and affordability, building standards and low-cost solutions, formalization and exclusion. Understanding these complexities and trade-offs was a critical component in arriving at a practical research agenda that balances core priorities and concerns. Another benefit of an open co-design process was in better positioning the project in relation to existing programmes of work such as a city-wide incremental upgrading programme in one of the case sites in Durban. Partnerships involving academics and practitioners have also helped to build credibility with local communities, and offered invaluable practical feedback on academic theories.

Results to date: The transdisciplinary approach helped to focus the scientific outcomes on producing context-specific socio-technical knowledge. To transform technical know-how into workable solutions, stakeholders need to work together in addressing critical issues such as co-financing in the private and public realms, regulatory flexibility (affordability and safety) and community-based acceptance and coordination according to an agreed master plan. For example, focus group discussions on housing

A multi-storey alternative housing prototype developed by the project. Photo belongs to the project

preferences revealed that there were some cultural aversions to apartment-style living, with a preference for rental through kinship. This impacts on the position of the stairway when designing a family unit. Similarly, mitigating against the risk of fire was a critical factor in a person's willingness to invest in their structure.

A key scientific project result has been the design and construction of a multi-storey alternative housing prototype that consists of a low-cost, lightweight, double-story wood-frame structure with deep pile foundations, metal cladding, appropriate insulation and fire safety criteria. The design has been named the 'Indlulamithi' or 'LIFT' house (LIFT = lightweight, improved, fire-safe, timber frame; Indlulamithi means 'the wood-frame house which stands tall' and also the isiZulu word for a giraffe). The design was submitted as an entry for an AfriSam-SAIA (South African Institute of Architects) Sustainable Design Award 2019/20. The project also has contributed to the scientific body of knowledge and practice by showing that more attention needs to be given to the spatial configuration of informal settlements in the upgrading process. The project has shown that a participatory process of planning and spatial reconfiguration (also known as 're-blocking') can support the creation of a services grid for more comprehensive infrastructure investment and the general functionality of the settlement. Multi-storey top-structures are one tool for freeing up space in creating an effective spatial layout while minimizing the need for relocations.

By combining ideas and expertise from the fields of architecture, urban planning, and economics, the project offers a more holistic approach to informal settlement upgrading.

In Durban, the outputs of the research process feed into the city's 'iQhazai Lethu' Updating Partnership programme, which seeks to institutionalize an incremental in-situ upgrading policy. A demonstration LIFT unit was completed and handed over to a local community member from Parkington Informal Settlement in September 2020. This approach to upgrading has been strongly supported by eThekwini municipality with a new incremental upgrading policy adopted by Council in June 2022 – although implementation on the ground has yet to be mainstreamed. Successful demonstration projects are critical in shifting mindsets at this point. The project partner in Angola, the Development Workshop, has also taken forward inputs from the LIRA study in reviewing the National Housing Policy for the Ministry for Urbanisation and Territorial Planning.

The research was profiled at different events, including the UN-Habitat National Housing Policy Conference, Luanda, the Research and Policy Advocacy Department (RAPA) of the eThekwini Municipality, the Urban Futures Centre (Durban University of Technology) Living in the City Symposium, the HSRC Seminar Series, and the Public Sector Economic Forum. Most recently, a national webinar on 'Alternative housing and planning solutions in incremental upgrading' was hosted by eThekwini Municipality with its partners in June 2022.

Academic outputs so far include:

- Visagie, J., Misselhorn, M., Scheba, A. and Turok, I. 2020. Reconfiguring dense informal settlements is in the policy spotlight – and rightly so. *Daily Maverick*, 17 July 2020. www.researchgate.net/publication/343307155_Reconfiguring_dense_informal _settlements_is_in_the_policy_spotlight_-and_rightly_so
- Visagie, J. and Turok, I. 2020. Getting urban density to work in informal settlements in Africa. *Environment and Urbanization*, Vol. 13, No. 2. http://doi.org/10.1177/0956247820907808
- Visagie, J., Turok, I. and Misselhorn, M. 2020. Upgrading dense informal settlements by building upwards: lessons from an informal settlement in Durban, South Africa. HSRC Policy Brief Series. May 2020. https://repository.hsrc.ac.za/handle/20.500.11910/15420

10

LIRA PROJECT

Management of shared sanitation facilities in low-income settlements of Kisumu (Kenya) and Kumasi (Ghana)

This project contributes to SDG 6 and SDG 11

This LIRA project (2018–2020), led by **Sheillah Simiyu at Great Lakes University of Kisumu (and now at the African Population and Health Research Center), Kenya**, aimed to co-design effective strategies for managing high-quality shared sanitation facilities in low-income settlements in Kisumu (Kenya) and Kumasi (Ghana). Informal settlements in Africa are characterized by poor living conditions, including a lack of basic services such as water and sanitation. It is common for households in these settlements to have shared sanitation arrangements, but these shared facilities are typically unclean and unhygienic. In light of this, the project set out to achieve three objectives, as follows: to characterize existing sanitation facilities in informal settlements in the project cities; to identify barriers and opportunities for effective management of shared sanitation in those settlements; and to co-design management strategies that promote proper and sustained management of shared sanitation facilities.

Expertise and partners involved: The project brought together four senior researchers and a team of research assistants based at Great Lakes University of Kisumu. These academics were drawn from the fields of urban development, environmental engineering, public health, environmental governance and geography, community development and environmental studies. The research team engaged with non-academic stakeholders from government and civil society. The project's main stakeholders in Kisumu were the Kisumu County Government and NGOs such as Practical Action. The stakeholders in Kumasi were Kumasi Metropolitan Assembly and NGOs such as Water and Sanitation for the Urban Poor. In both cities, the project also engaged with key community actors such as health volunteers/health assistants, municipality representatives, traditional leaders and community members.

Methods applied to deliver research: The project was implemented in three sequential stages. During the first stage, cross-sectional surveys were used to characterize the existing sanitation facilities being shared in the informal settlements. In the second stage, In-depth interviews were held with users of the shared facilities at the compound level as well as landlords, tenants, and community leaders. Focus group discussions were also conducted to understand the challenges, behaviours, practices, and norms associated with management of shared sanitation facilities. The final stage involved co-designing management strategies for the shared sanitation facilities with users and the relevant community-level stakeholders. The strategies were developed through a series of workshops and group discussions with government and non-governmental stakeholders and community members.

Results to date: Sanitation facilities were mainly shared among landlords and tenants. Social and physical opportunities for improving the cleanliness of shared toilets were most evident, with participants acknowledging that positive relationships, communication and cooperation among users, mutually established cleaning plans, and the quality of the toilet influenced the cleanliness of shared toilets. Strategies for improvement included instituting clear cleaning plans, improving communication

among users, and promoting enhanced problem-solving mechanisms between landlords and tenants. These strategies were tested in selected compounds through visits led by the research team and community health volunteers. The uptake of these strategies showed their potential for implementation, as improved communication enabled residents within each compound to formulate management strategies collectively. The process also led to the adoption of additional management strategies initiated by community members.

The project has resulted in the publication of five journal articles:

- Simiyu, S., Antwi-Agyei, P., Adjei, K. and Kweyu, R. 2021. Developing and testing strategies for improving cleanliness of shared sanitation in low-income settlements of Kisumu, Kenya. *The American Journal of Tropical Medicine and Hygiene*, Vol. 105, No. 6, pp. 1816–25. https://doi.org/10.4269/ajtmh.20-1634
- Antwi-Agyei, P., Monney, I., Adjei, K. A., Kweyu, R. and Simiyu, S. 2022. Shared but clean household toilets: what makes this possible? Evidence from Ghana and Kenya. *International Journal of Environmental Research and Public Health*, Vol. 19, No. 7. https://doi.org/10.3390/ijerph19074271
- Antwi-Agyei, P., Dwumfour-Asare, B., Adjei, K. A., Kweyu, R. and Simiyu, S. 2020. Understanding the barriers and opportunities for effective management of shared sanitation in low-income settlements – the case of Kumasi, Ghana. *International Journal of Environmental Research and Public Health*, Vol. 17, No. 12. https://doi.org/10.3390/ijerph17124528

Shared sanitation facilities in low-income settlements. Photo belongs to the project

- Simiyu, S. N., Kweyu, R. M., Antwi-Agyei, P. and Adjei, K. A. 2020. Barriers and opportunities for cleanliness of shared sanitation facilities in low-income settlements in Kenya. *BMC Public Health*, Vol. 20, pp. 1–12. https://doi.org/10.1186/s12889-020-09768-1
- Tidwell, J., Chipungu, J., Ross, I., Antwi-Agyei, P., Alam, M. U., Tumwebaze, I. K., Norma G., Cumming, O. and Simiyu, S. 2020. Where shared sanitation is the only immediate option: a research agenda for shared sanitation in densely populated low-income urban settings. *The American Journal of Tropical Medicine and Hygiene*, Vol. 104, No. 2, pp. 429–32. https://doi.org/10.4269/ajtmh.20-0985

In addition, the project has produced two briefs aimed at policy-makers: one on improving the quality and management of sanitation facilities, and the other on the dynamics of shared sanitation arrangements in low-income settlements.

11

LIRA PROJECT

Integration of housing and health policies for inclusive, sustainable African cities

This project contributes to SDG3 and SDG 11

Using Cape Town, South Africa, and Douala, Cameroon, as case studies, this LIRA project (2018–2020), led by **Tolu Oni from the University of Cambridge School of Clinical Medicine, UK, and the University of Cape Town, South Africa**, seeks to develop a practical health and housing-integrated collaboration model that will improve urban policy-making and governance for the planning of African cities. The project brings together academic and non-academic stakeholders representing a range of expertise: public health, health geography, urban planning and demography.

Methods: The research is conducted in two phases. Phase one explores existing policies and governance structures in Cape Town and Douala through desktop research and in-depth interviews with government officials. The aim is to identify synergies, shared benefits and collaboration opportunities between government bodies and policies in housing and health. Using stakeholder engagement, phase two works with policy partners to investigate approaches to integrating quantitative data across government sectors to inform future evaluation of the health impact of housing interventions for the urban poor in Cape Town and Douala. The engagement process is documented in an article which is currently under review.

The emerging results so far point to an overall willingness for and interest in collaboration between these sectors. However, collaboration is hampered by narrow perceptions of the definition of health and housing and by the roles and responsibilities of the relevant sectors; and by siloed mandates that do not align performance indicators with aspirations of intersectoral collaboration for health and wellbeing.

The concept for this LIRA project was developed through consultative workshops. The first workshop, in Cape Town, brought together researchers across different disciplines whose work was related to health directly or indirectly. Prior to the workshop, attendees completed a survey to detail key aspects of their research and their perspective on how this related to urban health. During the workshop, the existing evidence and knowledge gaps were iteratively discussed, culminating in the identification of key research gaps for urban health in Africa.

This was followed by a second workshop in Cape Town, to which senior policy representatives from a wide range of government departments (including health, education, environmental affairs, human settlements and public works) were invited. The purpose of this workshop was to hear from a range of policy sectors on their current and upcoming priorities, ongoing work addressing these priorities, and potential areas of overlap with the research gap identified by the researchers. This iterative process resulted in identifying a research agenda on integrating health and housing policies, and raised awareness of existing activities across different departments.

Similar activities took place in Douala. A workshop brought together local academics and representatives from national and local government, the private sector, and civil society. They explored experiences of intersectoral action between the health and planning sectors, understandings of key urban challenges, and implications for health. The process of engaging these actors has been documented in an article, which is currently under review.

Results to date: Following these workshops, a policy position paper calling for bolder action on health in Africa was developed and presented at the Second WHO Africa Health Forum to influence policy discussion. Furthermore, the project developed recommendations for action to break down non-communicable disease silos in Africa. The project is also partnering with the WHO Regional Office for Africa to develop training tools for intersectoral action for health that will be used by the WHO Healthy Cities Initiative.

The PI was invited to give a public lecture at the conference Hacking the Future: New Ideas for an Urban Era in Cape Town, June 2019, and to present her research at the Gates Grand Challenges annual meeting in Addis Ababa, October 2019. The engagement with different partners also helped to leverage additional funding that enabled the expansion of the Cape Town workshop to a pan-African focus.

The project led to the establishment of the UrbanBetter platform. This is a learning collaborative and advocacy platform that seeks to foster shared learning, knowledge exchange and public engagement, connecting and mobilizing individuals, communities and organizations for healthy sustainable urban environments.

To date, the following knowledge products have been developed by the PI and the collaborators:

- Oni, T., Kockat, J., Martinez-Herrera, E., Palti, I., Johns, A. and Caiaffa, W. T. 2019. The healthcare community needs to champion healthy and sustainable urban living spaces. *The BMJ Opinion*. https://bit.ly/340kfmz
- Oni, T., Mogo, E., Ahmed, A. and Davies, J. I. 2019. Breaking down the silos of universal health coverage: towards systems for the primary prevention of non-communicable diseases in Africa. *BMJ Global Health*. http://dx.doi.org/10.1136/bmjgh-2019-001717
- Vearey, J., Luginaah, I., Magitta, N. F., Shilla, D. J. and Oni, T. 2019. Urban health in Africa: a critical global health priority. *BMC Public Health*, Vol. 19. https://doi.org/10.1186/s12889-019-6674-8
- Weimann, A. and Oni, T. 2019. A systematised review of the health impact of urban informal settlements and implications for upgrading interventions in South Africa, a rapidly urbanising middle-income country. *International Journal of Environmental Research and Public Health*, Vol. 16, No. 19. https://doi.org/10.3390/ijerph16193608
- Weimann, A., Kabane, N., Jooste, T., Hawkridge, A., Smit, W. and Oni, T. 2020. Health through human settlements: investigating policymakers' perceptions of human settlement action for population health improvement in urban South Africa. *Habitat International*, Vol. 103. https://doi.org/10.1016/j.habitatint.2020.102203
- Weimann, A., Nguendo-Yongsi, B., Foka, C., Waffo, U., Carbajal, P., Sietchiping, R. and Oni, T. 2020. Developing a participatory approach to building a coalition of transdisciplinary actors for healthy urban planning in African cities – a case study of Douala, Cameroon. *Cities & Health*. https://doi.org/10.1080/23748834.2020.1741966
- Ebikeme, C., Gatzweiler, F., Oni, T., Liu, J., Oyuela, A. and Siri, J. 2019. Xiamen Call for Action: building the brain of the city – universal principles of urban health. *Journal of Urban Health*, Vol. 96, No. 4, pp. 507–09. https://doi.org/10.1007/s11524-018-00342-0

- Gatzweiler, F., Fu, B., Rozenblat, C., Su, H-J. J., Luginaah, I., Corburn, J., Boufford, J. I., Valdes, J. V., Nguendo-Yongsi, B., Howden-Chapman, P., Singh, R. B., Cooper, R., Oni, T. and Zhu, Y-G. 2020. COVID-19 reveals the systemic nature of urban health globally. *Cities & Health.* https://doi.org/10.1080/23748834.2020.1763761
- Nguendo-Yongsi, B., Muzenda, T., Bertrand Djouda Feudjio, Y., Kenfack Momo, D.N and Oni, T. 2022. Intersectoral collaboration for healthier human settlements: perceptions and experiences from stakeholders in Douala, Cameroon. *Cities & Health,* Vol. 6, No. 3, pp. 602–15. https://doi.org/10.1080/23748834.2022.2078071
- Muzenda, T., Dambisya, PM., Kamkuemah, M., Gausi, B., Battersby, J. and Oni, T. 2022. Mapping food and physical activity environments in low- and middle-income countries: a systematised review. *Health Place*, Vol. 75, 102809. https://doi.org/10.1016/j.healthplace.2022.102809

In addition, the following three manuscripts are being drafted:

- The use of intersectoral data for monitoring associations between place and health within an informal settlement in Cape Town, South Africa.
- Opportunities for integrating health into green building initiatives in sub-Saharan Africa.
- Multisectoral interventions to improve population health in Africa: a systematic review.

LIRA project team from University of Cape Town (UCT), University of Yaoundé I (UY) and UN Habitat. Photo belongs to the project

12

LIRA PROJECT

Green spaces and repurposing waste: Building capacities for resilience in urban and peri-urban West Africa (GREEN BUILDERS)

This project contributes to SDG 2, SDG 5, SDG 6, SDG 7, SDG 11, SDG 12 and SDG 13

This LIRA project (2018–2020), led by **Safiétou Sanfo at the West African Science Service Centre on Climate Change and Adapted Land Use (WASCAL), Burkina Faso**, was initiated with the overall aim of enhancing liquid and solid waste collection, recycling and repurposing to benefit urban and peri-urban agriculture (UPA) as well as the development of green urban spaces (GUS) and green energy in Ouagadougou, Burkina Faso and Tamale, Ghana. The specific objectives of the project were to:

- Map out, study, and build on advantageous aspects of existing UPA, GUS, and the efforts of public and private companies in Burkina Faso and Ghana already involved in liquid and solid waste collection, recycling and repurposing, using existing waste treatment plants and projects as a baseline.
- Profile constraints in system operationalization that impede the success of both solid and liquid waste treatment and the use of repurposed waste in UPA and GUS.
- Contribute to estimating the socio-economic and ecological values of key ecosystem services provided through UPA and GUS, and propose recommendations to improve waste composting for both uses.
- Investigate the networks of relevant stakeholders (researchers, extension agents, community members, gardeners, city authorities and waste recycling companies) involved in repurposing waste and using it for UPA and GUS.
- Facilitate cross-country multi-stakeholder platforms to share best practices and co-produce new knowledge for improving and sustaining solid and liquid waste recycling and repurposing for use in UPA and GUS.

Expertise and partners involved: The project brought together nine researchers based at WASCAL and in Ghana. These researchers were drawn from the fields of agricultural economics, anthropology, agronomy, botany, biology, econometrics, geography and hydrology. The research team engaged with key stakeholders from the public and private sectors in both project cities. The main stakeholders in Ouagadougou were the National Office for Water and Sanitation, the National Biodigester Program, the Ministry of Environment and the Directorate of Sanitation at the Ouagadougou City Council. The main stakeholders in Tamale were Biogas Technologies Africa Limited, Zoomlion Ghana and Decentralized Composting for Sustainable Farming and Development – all private firms involved in waste collection and repurposing. In both cities, the project also engaged a range of small and medium-sized enterprises, solid waste collectors, beneficiary households, municipal market gardeners, tree and flower nursery enterprises, livestock farmers and local municipalities.

Methods applied to deliver research: The project employed a combination of natural and social scientific methods (field experimentation, GIS mapping, key informant interviews, focus group discussions and

Activities with plant nursery workers.
Photo belongs to the project

household surveys) and stakeholder engagement strategies to deliver participatory and transdisciplinary outcomes. Stakeholder engagement consisted mainly of knowledge exchange workshops which convened actors as diverse as officials from government departments for sanitation, energy and agriculture; medium-scale business involved at different points of the waste management value chain; and small-scale informal actors who, despite their importance to the system, have been historically excluded from policy-making and governance processes in both project cities. The workshops created space for these different actors to reflect on their respective roles in their city's waste management landscape – and, importantly, on ways to link up with other actors in the system to reduce waste and maximize efficiencies.

Results to date: The project facilitated a number of important social outcomes. In Ouagadougou, the project helped secure tenure extension for owners of plant nurseries who were facing the prospect of eviction and involuntary resettlement by city authorities. The project also enabled improvements in the operations of small-scale compost producers and market garden operators. A common thread underlying these achievements is the increased responsiveness of government actors to the resource needs (in particular, land and water) of UPA and GUS operators, enabled by the interactive stakeholder engagement fora initiated during the project. Further, the project inspired transdisciplinary collaborations for local tree-planting programmes, including a reforestation campaign led by the National Agency for Renewable Energies and Energy Efficiency in Burkina Faso.

The project produced two reports which were shared with stakeholders. Academic outputs to date include one journal article, one book chapter, one policy brief and four Master's theses, as follow:

➔ Sesan, T., Sanfo, S., Sikhwivhilu, K., Dakyaga, F., Aziz, F., Yirenya-Tawiah, D., Badu, M., Derbile, E., Ojoyi, M., Ibrahim, B. and Adamou, R. 2021. Mediating knowledge co-production for inclusive governance and delivery of food, water and energy services in African cities. *Urban Forum*. https://doi.org/10.1007/s12132-021-09440-w

- Sanfo, S., Neya, O., Da, S., Salack, S., Amikuzuno, J., Gandaa, B. Z., Hackman, K. O. and Ogunjobi, K. O. 2021. Waste recycling and repurposing to address SDG 11 in Burkina Faso: do multi-stakeholder platforms matter? Croese, S. et al. (eds), *Realizing the SDGs in African Cities*. Springer Nature.
- Sanfo, S., Salack, S., Sawadogo, A. and Ogunjobi, K. O. Forthcoming. Enabling the environment for waste recycling and repurposing in Burkina Faso.
- Sawadogo, A. 2019. Response of vegetables to fertilization by municipal and farm composts. Master's thesis, University of Nazy Boni, Bobo Dioulasso, Burkina Faso.
- Sontie, A. 2019. Floristic diversity and ecosystem services within green spaces of Ouagadougou. Master's thesis, University of Nazy Boni, Bobo Dioulasso, Burkina Faso.
- Inoussa, Q. 2019. Statistical analysis of the recycling and repurposing of household solid waste and waste water for peri-urban agriculture in Ouagadougou. Master's thesis, University of Ouagadougou, Burkina Faso.
- Tiendrebeogo, O. 2020. Assessment of vegetable production systems in the urban and peri-urban area of Ouagadougou. Master's thesis, University of Aube Nouvelle, Ouagadougou, Burkina Faso.

13

LIRA PROJECT

Co-producing urban knowledge in Angola and Mozambique through community-led data collection

This project contributes to SDG11

This LIRA project (2018–2020), led by **Sylvia Croese from the African Centre for Cities at the University of Cape Town, South Africa (now University of the Witwatersrand, South Africa)** in collaboration with Massamba Dominique from the NGO Development Workshop Angola and Inês Raimundo the Centre for Policy Analysis at Eduardo Mondlane University, Mozambique, seeks to establish more inclusive and innovative approaches to data collection for the monitoring and implementation of the SDGs in Luanda (Angola) and Maputo (Mozambique).

The project focuses on generating data on the indicators of SDG 11 'to make cities and communities more inclusive, safe, resilient and sustainable,' in three selected peri-urban settlements in each city. The aim is to use this data to inform more sustainable and participatory urban planning and policy-making. The project is designed to address the shortage of city-level data and the lack of platforms and mechanisms through which this data can be shared and used in context-specific ways. It is intended to create and strengthen local knowledge (co-) production and experience sharing amongst different stakeholders, within as well as between the cities of Luanda and Maputo.

Expertise and partners involved: In order to raise awareness of the SDGs and the project, and to discuss the research design and questionnaires, a range of different stakeholders was engaged in the inception phase of the research. In Luanda, these included local UN office representatives and government officials, representing the National Office of Statistics, the Urban Upgrading Office for Luanda (GTRUCS) and the Ministry of Planning and Housing, as well as local municipal administrations, NGO representatives and academia. In Maputo, stakeholders included local United Nations Development Programme and UN-Habitat office representatives and government officials, specifically the SDG focal persons appointed within the Ministry of Economy and Finances, the National Office of Statistics, as well as the National Association of Mozambican Municipalities (ANAMM). At the neighbourhood level, the research teams worked with university students, community members and local resident committee representatives.

Methods: The research methods employed included participatory mapping exercises, focus groups, one on one meetings and interviews with key informants, and survey work using GIS-enabled tablets, resulting in a total of 1,282 surveys. Community and stakeholder workshops were used to present, discuss and validate the research questions and findings.

In both cities, the project attracted both interest at national government level and active participation by the community. However, a challenge was to bring in the municipal government as a partner in the research. In Luanda, this was because the ability of municipal governments in Angola to plan and implement urban interventions remains limited (although recent decentralization reforms have given them more responsibilities). In Mozambique, decentralization of power to the local level is more

advanced, but the local elections that took place during the research resulted in changes in local leadership, making it difficult for the research team to engage the right people.

Ongoing challenges to city-level SDG monitoring and implementation are that existing data systems continue to be concentrated and centralized in national statistics institutes for whom working with non-traditional data actors and methodologies is new, as well as a lack of capacity and resources at local government level to build their own data systems.

Overall, the research findings pointed to the need to adapt and localize SDG targets with indicators that are appropriate at the local level, and to the need to support and learn from community solutions to local challenges. The final phase of the project therefore focused on the ways in which the project data and findings can contribute to policy-making and implementation for the SDGs at the city level. City to city knowledge exchanges were central to such learning. A representative from ANAMM was part of the final project workshop in Luanda in October 2019 to share ANAMM's experience in supporting SDG localization at the municipal level in Mozambique, while a Development Workshop representative participated in a train the trainer workshop on SDG localization for local governments in Maputo in November 2019.

Results to date: In both cities, the project contributed to increased knowledge and understanding between research actors and stakeholders. These relate both to the SDGs and to the need for more inclusive and bottom-up ways of generating, monitoring and evaluating knowledge and interventions. The project activities also led to productive relationships with the National Association of Mozambican Municipalities, the United Cities and Local Governments Association (UCLG) and the UN agencies in both

Project field visit in Mozambique.
Photo belongs to the project

countries. In 2019, the PI was a lead author for the Africa chapter of the UCLG report *The Localization of the Global Agendas*.

Findings of the project were included in Mozambique's first Voluntary National Review which was presented during the United Nations High-level Political Forum on Sustainable Development in 2020. The PI's reflections on this process can be found in this blog: *LIRA2030 research informs implementation of the Sustainable Development Goals in Mozambique*.

The final project workshop in Maputo in November 2020 was hosted by the Maputo City Council, which recognized the need to identify SDG liaisons at the city level so that these can feed back to the National Reference Group on SDGs and push for the inclusion of city-level data for SDG monitoring and implementation. The Co-PI, Inês Raimundo from the Centre for Policy Analysis at Eduardo Mondlane University, was also invited to present the research findings to the Councilmen of the Maputo City Council and this presentation was very well received. In Angola, Development Workshop was invited to be part of the technical committee for the development of Angola's first Voluntary National Review. Development Workshop was also part of working group 2 on social welfare, which covers SDG11. Angola's Review was presented to the UN in 2021 and is available here.

Using a transdisciplinary approach helped the research team to have a better understanding of local needs and realities, and of the ways in which the SDGs are interlinked in practice. However, co-producing locally grounded knowledge requires time, effort and an ability to engage with different actors, who all have different interests and expectations. It was crucial to be open to incorporating change and new learning into the research process on a continuous basis. Further funding opportunities are being sought to extend the work to other cities in the same countries, and for supporting the monitoring and implementation of specific policy interventions.

Articles and books co-produced/edited by the PI include:

- Croese, S., Dominique, M. and Raimundo, I. M. 2021. Co-producing urban knowledge in Angola and Mozambique: Towards meeting SDG 11. *npj Urban Sustainability*, Vol. 1, No. 8. https://doi.org/10.1038/s42949-020-00006-6
- Marrengane, N. and Croese, S. 2021. *Reframing the Urban Challenge in Africa: Knowledge Co-production from the South*. London and New York, Routledge.
- Croese, S. and Parnell, S. 2022. *Localizing the Sustainable Development Goals in African Cities*. New York, Springer.
- Croese, S. 2022. Toward an Embedded, Integrated, and Collaborative Approach to SDG Localization in African Cities. In: Croese, S., Parnell, S. (eds) Localizing the SDGs in African Cities. Sustainable Development Goals Series. Springer, Cham. https://doi.org/10.1007/978-3-030-95979-1_1
- Laíce, P., Croese, S. 2022. Mozambique's Voluntary Local Review: SDG Localization, Decentralization, and the Role of Local Governments and Associations. In: Croese, S., Parnell, S. (eds) Localizing the SDGs in African Cities. Sustainable Development Goals Series. Springer, Cham. https://doi.org/10.1007/978-3-030-95979-1_11
- Mejía-Dugand, S., Croese, S. and Reddy, S. A. 2020. SDG implementation at the local level: lessons from responses to the coronavirus crisis in three cities in the Global South. *Frontiers in Sustainable Cities*, Vol. 2. https://doi.org/10.3389/frsc.2020.598516

All data collected and generated by the project are publicly available through an online data repository, from which the survey data have been downloaded over 1,000 times: 592 downloads of the Maputo survey data and 690 downloads of the Luanda survey data. Summaries of the project's final results in both English and Portuguese were locally disseminated and are also available online on the Datafirst repository.

The PI delivered project presentations (in English or Portuguese) at various events, including the 2019 International Conference on Sustainable Development, Columbia University, USA; the International SDG Research Symposium GLOBAL GOALS 2020, Netherlands; Architecture Forum 2021, Angola; and Sustainability Research & Innovation Congress 2021, Australia.

The PI also presented on the research as part of several teaching engagements, including a course on Understanding International Urban Policy for MA students at the Institute for Housing and Urban Development Studies, Erasmus University Rotterdam, Netherlands in 2020 and 2021, and invited guest lectures at the Faculty of Architecture of Universidade do Porto, Portugal; Environmental and Geographical Sciences Department, University of Cape Town; and the Faculty of Arts and Social Sciences, Eduardo Mondlane University.

Public speaking engagements further included a policy podcast on Reaching the SDGs developed by Oxford University. In 2021, the PI was nominated as one of *Apolitical's* '100 most influential academics in government', a global platform for public servants and policy-makers.

14

LIRA PROJECT

Bridging decentralized energy planning with neighbourhood-level innovations in cities of Africa: Case studies from Ghana and South Africa

This project contributes to SDG 7, SDG 11 and SDG 13

This LIRA project, led by **Kweku Koranteng at Stellenbosch University, South Africa**, explored energy transitions within the self-organizing and sustaining context of urban sub-Saharan Africa. Cities across Africa are undergoing an urban energy transition in a bid to address the environmental challenges associated with fast-paced urbanization and increasing carbon emissions, while contributing to the implementation of the 17 SDGs, particularly SDG 7 (affordable and clean energy), SDG 11 (make cities inclusive, safe, resilient and sustainable) and SDG 13 (take urgent action to combat climate change and its impacts).

Against this background, the project explored the boundaries of an imagined sustainable energy future through the lenses of ongoing renewable energy projects at various scales in Accra, Ghana and Stellenbosch, South Africa. The project focused on four main technological interventions – solar lamps, rooftop household solar systems, off-grid solar systems and on-grid solar systems – in three selected cases. The specific objectives of the project were to: influence the national energy system with bottom-up neighbourhood-level knowledge; empower communities with communication, leadership and negotiation skills; empower practitioners with technical know-how, including through introspection and reflection; sharing best practice with African cities outside of Ghana and South Africa; and contribute to the body of knowledge on how the SDGs can be made practical in complex urban settings in Africa.

Expertise and partners involved: The project brought together four researchers based at Stellenbosch University. These academics were drawn from the social sciences, urban planning and energy research fields. The non-academic partners on the project – Slum Dwellers International, Ghana Federation of the Urban Poor, People's Dialogue on Human Settlements and iShack – were all civil society representatives. The team engaged with stakeholders at the national and local government and community levels. The key stakeholders in Accra were the Energy Commission of Ghana, the Electricity Company of Ghana, Ashaiman Municipal Assembly, Ashiedu Keteke Sub Metropolitan Assembly and community representatives in Bukom. The main stakeholders in Stellenbosch were Stellenbosch Municipality and community representatives in Lynedoch Eco Village and Enkanini.

Methods applied to deliver research: The project employed a transdisciplinary approach comprising consultative methods (chiefly key informant interviews) and workshops in both cities.

Results to date: The project achieved the objectives stated at the outset, as follows:

- Influencing the national energy system with bottom-up neighbourhood-level knowledge. The project's role in disseminating the knowledge from experimental energy transition projects has gained recognition and galvanized action in policy circles. In Ghana, this is evident in initiatives such as the establishment of a Ministry of Zongo and Intercity Development and the allocation of a special purpose development fund to support interventions in slum upgrading.

- Empowering communities with communication, leadership and negotiation skills. By facilitating workshops and learning exchanges between government officials and community representatives, the project unlocked the potential for mutually beneficial relationships between those actors.
- Empowering practitioners with technical know-how. The process of engagement with stakeholders revealed major barriers to the provision of clean energy in informal settlements. Key proposals that emerged for strengthening regulation and support were the institution of self-regulated tariff mechanisms and the integration of small off-grid systems (below 100-megawatt capacity) into the national grid.
- Sharing best practices with other African cities. This objective is being achieved through continued engagement with stakeholders and the dissemination of project outcomes through various outlets. A key output is a video titled 'Bridging decentralized energy planning with neighbourhood-level innovations in cities of Africa,' available on YouTube. Beyond the project, the PI joined ICLEI – Local Governments for Sustainability (Africa) as a technical lead on another project aimed at improving energy access in other informal settlements. The PI is also part of the Enabling African Cities for Transformative Energy Access (ENACT) project which is supporting informal settlements in Freetown (Sierra Leone) and Kampala (Uganda) to improve access to cleaning cooking solutions.

Written outputs developed by the project include:

- Koranteng, K., 2021. *Benchmarking energy access: case studies from five informal settlements in the Global South*. ICLEI – Local Governments for Sustainability (Africa).

Enkanini.
Photo belongs to the project

- Ambole, A., Koranteng, K., Njoroge, P. and Luhangala, D. L. 2021. A review of energy communities in sub-Saharan Africa as a transition pathway to energy democracy. *Sustainability*, Vol. 13, No. 4. https://doi.org/10.3390/su13042128
- Bloem, S., Swilling, M. and Koranteng, K. 2021. Taking energy democracy to the streets: socio-technical learning, institutional dynamism, and integration in South African community energy projects. *Energy Research & Social Science*, Vol. 72. https://doi.org/10.1016/j.erss.2020.101906
- Kareem, B., McClure, A., Walubwa, J., Koranteng, K., Mukwaya, P. I. and Taylor, A. 2022. Power dynamics in transdisciplinary research for sustainable urban transitions. *Environmental Science & Policy*, Vol. 131, pp. 135–42. https://doi.org/10.1016/j.envsci.2022.02.001

15

LIRA PROJECT

Standardizing city-level data-gathering towards achieving Sustainable Development Goal 11 in Africa (SCiLeD)

This project contributes to SDG 11 and SDG 16

This LIRA project (2018–2020), led by **Peter Elias at the University of Lagos, Nigeria**, was implemented in Accra, Ghana and Lagos, Nigeria with a primary focus on SDG 11 (sustainable cities), particularly the targets relating to safe and affordable housing, inclusive and sustainable urbanization, affordable and sustainable transport systems, reduction of the adverse effects of natural disasters and reduction of environmental impacts within cities. The project utilized stakeholder engagement platforms to involve academic experts, governments, businesses, civil society and community groups in the prioritization and localization of these SDG targets.

The premise of the project was that social and spatial inequalities are strongly connected to data inequalities, especially in slums and informal settlements in Africa. Across the region, there is a paucity of data on the people – more than 65 percent of the urban population – living in these settlements. Highly aggregated national, regional and municipal or district social and environmental data often mask local realities. The lack of accurate, relevant and suitable data on informal settlements makes urban governance and planning difficult, and this, in turn, leads to the proliferation of such settlements. Further, urban data are typically collected in silos, in different time periods/frequencies, in different formats and for various uses, culminating in a failure to ensure safe, inclusive, resilient and sustainable cities and communities for all. With a focus on addressing these issues, the project used a transdisciplinary research approach to connect government, academic, business, civil society and community actors for the purpose of producing, sharing and using reliable data that incorporate multiple perspectives and further social learning and empowerment.

Expertise and partners involved: The SCiLeD project brought together researchers based at the University of Lagos and the University of Ghana. These researchers were drawn from the fields of development geography, environment and sanitation studies, sustainable housing and inclusive economies, urban and agricultural geography, and urban planning for water and sanitation. The research team engaged with various non-academic stakeholders in the urban space, from the domains of government, civil society, business and communities. The project's stakeholders in Lagos were the Lagos State Bureau of Statistics, Lagos Urban Renewal Agency, Justice & Empowerment Initiatives, the Nigerian Federation of Slum/Informal Settlement Dwellers, OEA Consults Limited and Immersive Location Solutions. The stakeholders in Accra were the Ghana Statistical Agency, Accra's Department of Urban Roads, the Accra Metropolitan Assembly, the People's Dialogue for Human Settlements and the Ghana Federation of the Urban Poor.

Methods applied to deliver research: The SCiLeD project followed a series of interrelated steps. First, the research team convened a focal point meeting of key experts from government, academia, civil society and project communities. This group became the think tank for the project. The group started

by reviewing the ten SDG 11 targets and indicators and localizing them to align with the priorities of the two project cities. Five priority targets (11.1, 11.2, 11.3, 11.5 and 11.6) emerged from this process and became the main themes of the study, defining the key sectors of engagement.

Second, the team undertook identification and mapping of stakeholders in the key sectors defined in the first step. Stakeholders were selected on the basis of their interest, influence, impact, organizational mandate and/or activities. Third, the team convened an inception workshop which brought together stakeholders from government ministries, departments and agencies, academia, civil society, international organizations, the media and urban grassroots movements (in particular, the Nigerian Federation of Slum/Informal Settlement Dwellers and the Ghana Federation of the Urban Poor). An institutional survey was conducted during the workshop to examine the status of urban data governance in the context of SDG 11.

Following the workshop, the project was able to leverage the grassroots expertise of members of the Nigerian and Ghanaian Slum Dweller/Urban Poor Federations in profiling and mapping their communities. Three waterfront communities – in the Oworonsoki, Kosofe and Bariga areas – were involved in the grassroots mapping and survey activities undertaken in Lagos. In Accra, the project was implemented in the Old Fadama and Chokor settlements. The enumerators and mappers were selected from within the project communities. They were subsequently trained to administer pre-loaded questionnaires using the Kobo Collect software and then equipped with tablets to conduct the surveys themselves.

Fourth, the research team led the cleaning, analysis and presentation of data using graphical and pictorial illustrations. Fifth, small-area mapping was led by the urban modellers and students on the team, with contributions from the community profilers/mappers. The aim was to identify slum boundaries and map the facilities and assets existing within the boundaries of those communities. Sixth, the research team presented the project's findings back to the communities and other stakeholders in a technical validation workshop, which enabled them to interrogate, verify and validate the data. The ultimate aim was to empower the communities to use the data from the project as a powerful negotiating tool in future engagements with city authorities.

Results to date: The SCiLeD project has contributed to creating awareness about transdisciplinary research and the need to generate city-level data relating to the SDGs on several panel sessions, both physical and virtual. These include: the Urban Mobility Research Colloquium of the Rose Center for Sustainable Cities held in Addis Ababa, Ethiopia; the International Conference on Smart Sustainable Futures in Melbourne, Australia; the 13th Plenary of the Research Data Alliance in Philadelphia, USA; the Geo Human Planet Forum at Columbia University in New York, USA; the Centre for Housing and Sustainable Development at the University of Lagos, Nigeria; and the International FAIR Convergence Symposium in Paris, France.

The SCiLeD project has also caught the attention of a number of stakeholders at the local and international levels, opening the door to opportunities for partnership and collaboration at the Lagos Urban Studies Group which birthed the project. These opportunities include: hosting of a US Fulbright scholar working on a project titled 'Documenting Resilient Communities Fighting Climate Adaptation Apartheid in Lagos'; collaboration on the UK Research and Innovation (UKRI)-funded Integrated Deprived Area Mapping Network System (IDEAMAPS) project being piloted in Lagos, Accra and Nairobi; collaboration on a South African National Research Foundation-funded project titled 'Giving Voices to Slums: Creating a Digital Urban Platform for Community Self-Reporting of Vulnerability and Responses to COVID-19 in Lagos'; and collaboration with the Centre for Sustainable Cities, Healthy and Learning Cities and Neighbourhoods (SHLC). The project has also developed an interactive map that can be used to understand the status of service delivery as well as monitor and track progress of the SDGs at the city or community level.

The PI has been invited to contribute to scholarly initiatives and policy groups within and outside Africa, including the European Citizen Science Association Conference, Digital Rights Governance Framework, Citizen Science Africa Association, CODATA Task Group on Citizen Science for the Sustainable Development Goals, and African Open Science Platform.

Finally, the project contributed to the development of the following knowledge products:

- Sherbinin, A., Bowser, A., Chuang, T., Cooper, C., Danielsen, F., Edmunds, R., Elias, P., Faustman, E., Hultquist, C., Mondardini, R., Popescu, I., Shonowo, A. and Sivakumar, K. 2021. The critical importance of citizen science data. *Frontiers in Climate*. https://doi.org/10.3389/fclim.2021.650760
- Elias, P. and de Albuquerque, J. P. 2022. Data and the localization of Sustainable Development Goals in Africa: the case of SDG 11 in Lagos and Accra. Croese, S., Parnell, S. (eds), *Localizing the SDGs in African Cities*. Sustainable Development Goals Series. Cham, Springer. https://doi.org/10.1007/978-3-030-95979-1_8
- Elias, P., Mensah, A., Fasona, M., Amao-Taiwo, B. and Oyalowo, B. In review. A methodological framework for open data governance towards achieving Sustainable Development Goal 11 in West Africa: case of Lagos and Accra. *Frontiers in Research Metrics and Analytics*.

16

LIRA PROJECT

Community-led upgrading of informal settlements in Namibia and Zambia

This project contributes to SDG 11

This LIRA project (2018–2020), led by **Madelein Stoffberg at the Namibia University of Science and Technology**, aimed to gain transformative knowledge on informal settlement upgrading. Informal settlements in African cities are growing at a rapid rate due to urban migration, economic opportunities in urban areas and food shortages as a result of severe droughts. These settlements are often characterized by harsh living conditions, providing inadequate housing standards and posing health risks. In low-income countries, governments and municipalities can't keep up with the growth of informal settlements, resulting in the uncontrolled expansion of these settlements. Several strategies have been piloted to assist local municipalities and residents of informal settlements, including re-blocking or upgrading and prediction models planning for future growth. The transformative knowledge targeted by this project focused on enabling community-led upgrading through existing data collection processes and developing training programmes, methods and tools.

A member of the youth group explaining the artistic representation of the Dordabis area.
Photo: Francis Photo Studios

The project set out to achieve three main goals in its pursuit of transformative knowledge on community-led upgrading in Windhoek (Namibia) and Lusaka (Zambia). The first goal was to investigate existing informal settlement upgrade projects to map the relationships between community members, stakeholders, policy-makers and other influential actors. The second goal was to understand the various factors that influence community-led upgrading in those cities. The third goal was to explore different methods and tools that can be utilized for community-led upgrading, enabling the development of sustainable communities.

Drawing on the systemic grassroots approach developed by the Shack Dwellers Federation of Namibia (SDFN), the project explored bottom-up alternatives to traditional top-down methods of slum upgrading used by professionals. By analysing and extending approaches to upgrading that have been deemed effective by organizations of informal settlement dwellers, the project aimed to facilitate a transformation to a regime of self-determination in which urban residents are allowed to plan their own settlements so that their

Community-led upgrading process.
Photo belongs to the project

communities can become more resilient and inclusive. The reference intervention for the project was the Community Land Information Programme in Namibia; however, final site selection favoured areas with lower risk of COVID-19 transmission.

Expertise and partners involved: The project was implemented by a multidisciplinary research team consisting of architects, town and urban planners, a quantity surveyor, a land administrator, governance, management and leadership development specialists and urban geographers. Key non-academic partners from civil society included the Namibia Housing Action Group, which supports the SDFN, and the People's Process on Housing and Poverty in Zambia. These NGOs were central to the success of the project, as they helped the research team to secure rapport with community members over a long period. In addition, the NGOs had the capacity to implement informal settlement upgrading strategies on the ground. Other key stakeholders included local municipalities, regional authorities, the German Agency for International Cooperation (GIZ), the UNDP and private practitioners. Most importantly, the participation of community members on the project directly contributed to the co-production and design of the transformative knowledge generated in the process.

Methods applied to deliver research: The project used a transdisciplinary approach to co-design community interactions with all the stakeholders involved. This ensured that the communities were willing to participate, and that the results obtained were aligned with stakeholders' objectives. Participatory methods were developed to engage with stakeholders around community-led upgrading processes, spatial planning and socio-economic views of communities.

Stakeholders and workshop participants were identified through stakeholder mapping. The workshops were co-hosted by community members, who introduced their respective communities and the data available on them to all participants. For group activities, participants were allowed to choose the group or activity that best aligned with their interests. The media that were used throughout the project duration

included photovoice, mapping, model building, drama, spoken word and art. Using these methods, the project developed participatory tools to facilitate policy and spatial development, as well as to harness local knowledge towards the development of transformative ideas for community upgrading.

Results to date: The project achieved three key results. First, it helped to strengthen dwindling ties between researchers, local municipalities, council members and the participating NGOs, setting the stage for progress beyond the project duration. Second, it enabled the development of spatial plans as well as a better understanding of policies, processes and barriers to community-led upgrading in the project cities. Third, the participatory methods employed on the project promoted a bottom-up approach that can equip communities with the means to communicate their ideas. Those methods have become tools for engagement, spatial planning and the identification of socio-economic opportunities and challenges.

The process and results from the project have been documented in a report on the spatial development of Dordabis, Namibia, that includes spatial layouts and architectural solutions proposed by students at the Namibia University of Science and Technology. The project has also produced a draft paper on informal settlement upgrading from a community perspective.

Cohort 3

17

LIRA PROJECT

Cleaning from the bottom up: Inclusive stakeholder participation for integrated waste management in Accra (Ghana) and Lagos (Nigeria)

This project contributes to SDG 11

This LIRA project (2019–2021), led by **Temilade Sesan at the University of Ibadan, Nigeria,** had the overarching objective of bridging the substantial gap between informal and formal governance structures for waste management in Accra and Lagos, towards the realization of an integrated and sustainable approach to addressing the formidable environmental challenges faced by residents in both cities. Although informal actors in these cities have demonstrated a capacity to evolve decentralized systems for waste management over time, they have been unable to access the technical and policy support they need to maximize their contribution to the value chain. By improving the governance of community-based waste management initiatives and facilitating in-depth engagement between formal and informal actors in the sector, the project helped to establish multi-scalar connections upon which further collaboration and action can be built.

Expertise and partners involved: The project brought together five researchers based at the University of Ibadan, the University of Ghana and the University of Cape Town. These academics were drawn from the fields of environmental science, public health, sociology, economics and geography. The practice partners on the project (Rethinking Cities, Green Africa Youth Organization, En-pact Solutions) came from the waste management, public policy and media advocacy sectors. The relationship between the academic and non-academic partners on the project was mutually rewarding. In particular, the media advocacy partners, who had a lot of prior experience engaging with stakeholders in practice, helped the team refine some of the incorrect assumptions made about the waste management landscape initially. Conversely, these partners were able to incorporate some of the research findings generated by the academic partners into their waste management campaigns. The team engaged with an array of stakeholders from the public, private and civil society domains. The project's key stakeholders in Accra were the Ga East Municipal Assembly and the Borla Taxis and Tricycles Association. The main stakeholders in Lagos were the African Cleanup Initiative, Thermal Initiative, Biosphere Technologies Limited, the Environmental Health Department of the Apapa-Iganmu Local Council Development Authority, as well as seven communities under the Authority.

Methods applied to deliver research: The project conducted in-depth interviews and focus group discussions with individuals and affected groups (men, women, youth, informal worker associations) in the project communities. These yielded insights which were then used to engage formal stakeholders at the municipal and city levels on ways to integrate community-level needs and capacities into the planning and delivery of waste management services, from the collection, through to the disposal and recycling

A community clean-up exercise.
Photo belongs to the project

stages. The project found the stakeholder workshops and focus groups most effective in spurring collaboration among diverse actors, likely because of the face-to-face conversations they fostered. When the COVID-19 crisis forced a move to remote work in early 2020, the project team devolved a lot of engagement responsibilities to community actors, building the capacity of the latter in the process.

In the wake of the crisis, the project also ramped up public outreach through social media platforms (Twitter and Instagram) and interactive programmes on local radio stations.

Results to date: A major result facilitated by the project in Accra was the formation and registration of an association of informal waste workers with the Ga East municipality, an outcome that was previously considered too difficult to achieve. Indeed, this association was the first of its kind to achieve formal status in the city. The association has set up a governance structure, complete with an executive committee, that will enable it to keep functioning beyond the life of the project.

The flagship intervention in Lagos was a community clean-up exercise tagged the #GreatBadiaCleanUp, implemented in partnership with civil society actors. The exercise was the anchor for a community-wide behaviour change campaign driven by a committee of resident volunteers. This volunteer-led, democratic committee was also the first of its kind to be established for waste management purposes in the project area. The project distilled the findings from the campaign into a series of key points, which were shared on social media.

Some of the early reflections on the project were presented in a paper titled "Lessons from facilitating community-led waste management processes in Lagos, Nigeria" at the Conference on Climate Resilience and Waste Management for Sustainable Development hosted by the University of Ghana in October 2019. More recently, the PI on the project led the publication of a paper in the journal *Urban Forum*, in collaboration with other researchers on the LIRA programme:

➔ Sesan, T., Sanfo, S., Sikhwivhilu, K., Dakyaga, F., Aziz, F., Yirenya-Tawiah, D., Badu, M., Derbile, E., Ojoyi, M., Ibrahim, B. and Adamou, R. 2021. Mediating knowledge co-production for inclusive governance and delivery of food, water and energy services in African cities. *Urban Forum*. https://doi.org/10.1007/s12132-021-09440-w

➔ Sesan, T. and Siyanbola, W. 2021. "These are the realities": insights from facilitating researcher-policymaker engagement in Nigeria's household energy sector. *Humanities and Social Sciences Communications*, Vol. 8, No. 73. https://doi.org/10.1057/s41599-021-00754-5

In Nigeria, findings from the project have also been presented to stakeholders running for political office in upcoming elections, potentially contributing to the formulation of evidence-informed policies and laws in the waste management sector. Furthermore, the collaborations on the project enabled the PI to secure a competitive grant from the Volvo Educational Research Foundations. The grant was used to design and deliver an academic writing course to scholars of sustainable urban development in African universities in 2022.

18

LIRA PROJECT

Enhancing sustainability and resilience of African cities through a water–energy–food (WEF) nexus approach

This project contributes to SDG 2, SDG 6, SDG 7, SDG 11, SDG 13 and SDG 16

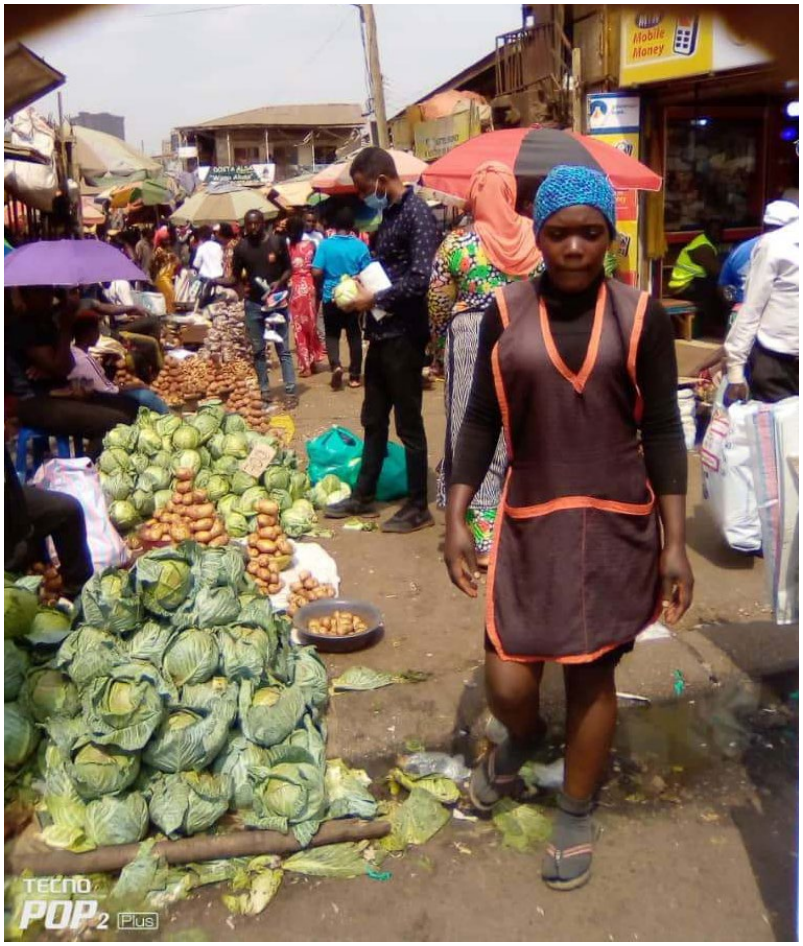
This LIRA project (2019–2021), led by **Deborah Darko at CSIR – Water Research Institute in Accra, Ghana**, adopted a WEF nexus approach to understand the nexus associated with the WEF systems in Accra (Ghana) and Kampala (Uganda), their resource bases and how those affect allocation, distribution and access to water, energy and food in both cities. The study further assessed WEF governance strategies and policy coherence across sectors by identifying synergies and trade-offs, policy options and governance arrangements that enhance water, energy and food security while achieving a more efficient use and integrated management of WEF resources to maximize social, economic and environmental outcomes in cities and their hinterlands. This project is important against the background of exponential urban growth rates in Africa: according to UN-Habitat, the urban share of the continent's population has doubled over the last 50 years and will reach 58 percent of the population by 2030. These factors, along with the changing climate, put a lot of pressure on the limited water, energy and food resources in many African cities. This, in turn, undermines the achievement of the SDGs in those cities, which are pivotal for the significant contributions they make to national economic outputs.

Expertise and partners involved: The project brought together eight researchers based at the University of Ghana, University of Uganda and University of Kenya. These academics were drawn from the fields of hydrology, remote sensing, climate/climate change adaptation, ecology and policy analysis, environmental and natural resource governance, gender, renewable energy, agriculture, land use and spatial planning, social science and economics. The non-academic partners on the project came from the urban planning (Ghana) and social work (Uganda) sectors. To facilitate the uptake of project outputs, the research team engaged public, private and civil society stakeholders across the water, food and energy sectors in the co-design and co-production of knowledge. The main stakeholders in Ghana included the Accra Metropolitan Assembly, Ministry of Sanitation and Water Resources, Ministry of Agriculture and Energy, Ghana Irrigation Development Authority, Ghana Water Company Limited, International Water Management Institute, International Food Policy Research Institute, and Alliance For African Women Initiative. Our stakeholders in Uganda included the Kampala Capital City Authority, Centre for Research on Energy and Energy Conservation, Ministry of Water and Environment, Spark Agro Initiatives Limited, National Water and Sewerage Corporation, National Agricultural Research Organization, and Environmental Surveys, Information, Planning and Policy Systems International Limited.

Methods applied to deliver research: The research team collected primary data by conducting household surveys, key informant interviews, as well as market and road surveys. The team obtained secondary data from the literature as well as relevant documents made available by stakeholders in the water, energy and food sectors. Other research methodologies employed by the team included WEF footprint analyses, mapping of WEF resources and infrastructure, climate change analysis, policy analysis, scenario modelling

and other statistical analyses. To gain in-depth understanding of the WEF nexus and associated challenges in the case study sites, the research team co-designed and conducted scenario development workshops with these stakeholders, who included representatives from civil society and the private sector. All participants at the workshops made inputs to the research design, tools and approaches proposed by the research team. Specifically, workshop participants collaboratively developed scenarios or shared visions for the governance of WEF systems and resources in the project cities. The co-production activities undertaken during the workshops enhanced the skills and competencies of both research team members and other stakeholders.

Results to date: The project has created awareness about the interactions, trade-offs and synergies in the provision and use of WEF resources at the stakeholder and household levels in Accra and Kampala. At the stakeholder level, the project increased the knowledge of WEF practitioners and policy-makers, city planners and representatives from NGOs and the private sector regarding the impacts of climate change on WEF resources and service delivery in both cities. In Accra, the project increased stakeholders' knowledge of decision-making processes and strategies that promote just, pro-poor, inclusive and sustainable WEF governance. This resulted in enhanced skills and competencies among city planners and WEF stakeholders in the design and use of WEF scenarios to inform decision-making and planning for infrastructure investment in Accra. The project team expects that the relationships and partnerships built with these stakeholders will be useful on future collaborative projects. Key outputs from the project include a land-cover map and a land-cover change detection map of Accra metropolis, as well as WEF data sets and infrastructure maps for both Accra and Kampala. Three knowledge products from the project are currently under development:



Food market in Ghana.
Photo belongs to the project

- Oulu, M., Darko, D., Osaliya, R., Aziz, F. and Wekesa, D. In review. Governing the nexus: water–energy–food nexus governance strategies in Ghana and Uganda. *Environmental Development*.
- Policy brief: *Achieving water, energy and food security in Ghana through nexus governance.*
- A short introductory course on the WEF nexus, covering theory, rationale, practice, governance, challenges and opportunities, to be offered to WEF practitioners and policy actors, the private sector and academic/research institutions.

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LIRA PROJECT

Household energy use practices and potential interventions for sustainable consumption in Makhanda-Grahamstown (South Africa) and Kumasi (Ghana)

This project contributes to SDG 7, SDG 11 and SDG 12

This LIRA project (2019–2021), led by **Gladman Thondhlana at Rhodes University, South Africa**, examined the effects of co-designing interventions for promoting sustainable electricity consumption in Makhanda and Kumasi. A key sustainability challenge in African cities is unsustainable electricity consumption by the residential sector which, in turn, results in negative environmental impacts, energy insecurity, high electricity expenditure and energy poverty, especially for low-income households. The project addressed this challenge at the household level in Makhanda and Kumasi, where current electricity-saving arrangements are driven by the power utilities, with negligible involvement of users. The project considered households' current electricity use practices and factors influencing these practices as a basis for co-designing electricity-saving interventions. The project aimed to show the importance of co-produced knowledge (emerging from partnerships between academic and local communities) and locally designed solutions for addressing the local sustainability challenge of wasteful electricity use.

Expertise and partners involved: The project benefited from the involvement of academic and non-academic partners. The academic partners were drawn from the fields of urban planning and environmental planning, and they brought expertise in qualitative research methodologies, multi-stakeholder engagement and social learning. The main societal stakeholders involved in both project cities were local residents, community champions and energy utility companies.

Methods applied to deliver research: The project used a combination of workshops, household surveys and formal and informal meetings to collect data and implement research activities. The research team began with several meetings with different stakeholders as a basis for collective problem formulation. The collaborations that were set up with societal stakeholders in both South Africa and Ghana shifted traditional boundaries and dynamics. The research team worked with different types of societal stakeholders to identify influential individuals relevant to the project theme, as well as the constraints faced by local households in accessing electricity. The formal and informal engagements with stakeholders allowed for the alignment of research goals with local needs, priorities and contextual realities. The transdisciplinary processes supported a shared understanding of the sustainability challenge and the development of societally relevant and user-driven electricity-saving interventions, which resulted in significant electricity savings. Workshops with community champions and residents, direct meetings with city officials and engagement with power utilities all contributed to the stock and flow of knowledge on the project. Information flowed across stakeholder groups and community champions and residents who, as indicated above, were the main societal stakeholders involved in the co-design of electricity-saving interventions. In the course of the project, the research team paused to reflect on the ease with which stakeholders were able to engage with the content of the intervention as well as its potential usefulness to them in the long term. The team invited different stakeholder

Stakeholder engagement activity in Ghana.
Photo belongs to the project

groups to take part in conversations that occurred after this visioning process, some of whom had not previously engaged with one another. In this way, the project attempted to build bridges between actors on the ground.

Results to date: The objective of the project at the outset was to promote a transition to sustainable household electricity use through collaborative knowledge generation between community members, power utilities and local government officials, with academics acting as knowledge intermediaries. The project provided opportunities for learning through the hosting of regular formal and informal meetings between researchers and local community champions. For example, through workshop interactions, participants discussed the electricity challenge as being beyond just a household problem and framed it, rather, as a community problem. The workshops allowed collaborators to gain insight into factors that constrained the ability of participants to implement energy saving interventions. For example, workshop participants highlighted that electricity-saving interventions were useful but insufficient if they did not include the 'backroom' households which are attached to the main households and their electricity supply but are rented out to different families. In summary, the social results of the project beyond electricity savings relate to enhanced agency among local residents in contributing to crafting small-scale solutions to address wasteful electricity use practices. The emergence of more engaged residents from the project served as a basis for highlighting the social responsibility of each actor.

Specific knowledge products developed on the project to date include:

- Mutumbi, U., Thondhlana, G. and Ruwanza, S. 2021. Reported behavioural patterns of electricity use among low-income households in Makhanda, South Africa. *Sustainability*, Vol. 13, No. 13. https://doi.org/10.3390/su13137271
- Thondhlana, G., Mubaya, C. P., McClure, A., Amaka-Otchere, A.B.K. and Ruwanza, S. 2021. Facilitating urban sustainability through transdisciplinary (TD) research: lessons from Ghana, South Africa, and Zimbabwe. *Sustainability*, Vol. 13. https://doi.org/10.3390/su13116205

- Mutumbi, U., Thondhlana, G. and Ruwanza, S. 2022. Co-designed interventions yield significant electricity savings among low-income households in Makhanda South Africa. *Energies*, Vol. 15, 2320. https://doi.org/10.3390/en15072320
- Mutumbi, U., Thondhlana, G. and Ruwanza, S. 2022. The status of household electricity use behaviour research in South Africa between 2000 and 2022. *Energies*, Vol. 15, 9018. https://doi.org/10.3390/en15239018
- Amaka-Otchere, A. B. K., Thondhlana, G. and Ruwanza, S. In review. Encouraging household energy conservation through transdisciplinary approaches in Ghana and South Africa: assumptions, challenges and guidelines. *International Journal of Urban Sustainable Development*.
- Ruwanza, S., Amaka-Otchere, A. B. K. and Thondhlana, G. In review. Challenges associated with community participation in a transdisciplinary research project on sustainable household electricity use. *Society & Natural Resources*.

20

LIRA PROJECT

Optimizing groundwater security by integrated approach of sanitation and hygiene in the coastal cities of Cotonou (Benin) and Lomé (Togo)

This project contributes to SDG 3, SDG 6 and SDG 11

This LIRA project (2019–2021), led by **Henri Sourou Totin Vodounon at the University of Parakou, Benin**, aimed to contribute to the achievement of sustainable sanitation and hygiene knowledge, attitudes and practices in the coastal cities of Benin and Lomé (West Africa). In both cities, well water is widely available but is often of low quality (and is therefore inaccessible) due to poor sanitation and inappropriate hygiene practices. The project addressed this by using a multi-stakeholder approach and socio-ecological mechanisms to promote access to sufficient quantities of acceptable safe groundwater in both cities.

Expertise and partners involved: The project brought together a transdisciplinary team of researchers from the University of Parakou, the University of Abomey-Calavi, the Regional Institute of Public Health, the Institute of Geography, Territory Planning and Environment, the National Academy of Sciences, Arts and Letters of Benin, the University of Lomé, the African Crafts School of Architecture and Urbanism, and the Regional Centre of Excellence on Sustainable Cities in Africa (CERVIDA–DOUNEDON). These researchers had expertise in groundwater quality analysis and quality modelling, urban-coastal land dynamics, environmental sociology, urban sociology and social change, urban planning, public health, epidemiology, urban ecology, waste recycling and the circular economy. The research team engaged with stakeholders from government, civil society and the private sector. The key stakeholders in Cotonou were the municipal council, the Office of Basic Hygiene and Sanitation, the Ministry of Health, the Ministry of Water, Radio Benin Alafia and the Centre Songhaï of Porto Novo. The main stakeholders in Lomé were ENPRO, STADD and Radio Nana FM. The project also received technical support from the UNESCO IHP FRIEND programme. Other stakeholders included business interest groups and local communities in both cities.

Methods applied to deliver research: The research methods employed on the project included collaborative field trips and iterative (seasonal) fieldwork, domestic well water sampling, water quality analysis and modelling, and co-exploration of urban environment characteristics to highlight groundwater quality deterioration processes. Multi-stakeholder meetings, interviews and focus groups were held to discuss the linkages between urban metabolism, sanitation and hygiene systems, groundwater quality and health risks in the project cities, with a view to enabling adoption of appropriate socio-ecological systems for groundwater security and sustainability. The applied nature of the research, involving a cycle of participation-learning-action, helped stakeholders on the project to collaboratively shape knowledge on sanitation for sustainable access to clean well water for domestic use in both cities.

Results to date: In both Cotonou and Lomé, the project contributed to changes in local knowledge and behaviour in the areas of sanitation, hygiene, waste management and integrated groundwater management. The project activities helped stakeholders to better comprehend the health risks

Groundwater quality sampling.
Photo belongs to the project

associated with poor water, sanitation and hygiene practices. The improved relationship between residents and their environment will help to secure the quality and accessibility of domestic well water by the 2030 target specified in the SDGs.

The project has resulted in the publication of three scientific articles to date:

- Vodounon, H. S. T. 2020. Métabolisme urbain et saisonnalité de la qualité des eaux de puits dans la ville côtière de Cotonou au Bénin. *Revue Sciences de l'Environnement, Université de Lomé (Togo),* Vol. 17, pp. 25–43.
- Vodounon, H. S. T., Houedakor, K. Z., Amoussou, E. and Dossou-Yovo, A. C. 2021. Effects of urban metabolism on the well water quality in Cotonou (Benin) and Lomé (Togo). *Journal of Water Resource and Protection,* Vol. 13, pp. 539–62. https://doi.org/10.4236/jwarp.2021.138030
- Vodounon, H., Azalou-Tingbé, E., Houedakor, K., Amoussou, E., Nantob, M., Adoho, G. and Odoulami, L. 2021. Alternative sanitation and strategic directives for the well water security in Cotonou (Benin) and Lomé (Togo). *Journal of Water Resource and Protection,* Vol. 13, pp. 675–98. https://doi.org/10.4236/jwarp.2021.139036

Further, the project has produced six Master's theses and five policy briefs on the following topics: well water quality and health risks; integrated and sustainable approaches to promoting sanitation and hygiene; integrated groundwater resource management; social change approach; and integrated socio-ecological systems of sanitation and hygiene for groundwater security in the cities of Cotonou and Lomé.

In addition, the project ran radio programmes in local languages (Goun and Fon in Cotonou; Mina and Ewe in Lomé). The team also produced six videos on a range of themes including the inaccessibility of available groundwater in Cotonou and Lomé and socio-ecological sanitation and hygiene systems for groundwater security in both cities.

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LIRA PROJECT

Enhancing urban wetland and river ecosystem health in Nigeria and South Africa

This project contributes to SDG 6 and SDG 11

This LIRA project (2019–2021), led by **Oghenekaro Nelson Odume at Rhodes University, South Africa**, applied an integrated approach that draws on socio-ecological system thinking and transdisciplinary research practice to investigate the ecological, social and institutional dimensions of urban rivers and wetland health in Nigeria and South Africa. The project approach departs from traditional assessments as it recognizes that ecological and socio-economic components form an integrated and dynamic complex system of urban ecosystem health. Rivers and wetlands in African cities are heavily degraded, negatively affecting the ecosystem services they provide to society and livelihoods. The project results suggest that for rivers and wetlands in African cities to be on a sustainable path, the link between policy, practice and research needs to be strengthened.

Integrated assessment metrics of urban river health are useful for providing detailed relational insights into the ecological, economic and governance implications of degraded urban river and wetland health, as well as the interrelationships between rivers and people in catchments. In this vein, the project set out to achieve four objectives:

1. Develop context-sensitive, holistic and multidimensional (i.e., ecological, social and economic) indicators of urban river and wetland health for tracking the trajectory of urban development.
2. Examine systemic institutional drivers of urban river and wetland health degradations and recommend ways to shift institutional practices for sustainable utilization of urban river resources.
3. Analyse the inextricable interactions and linkages between urban river and wetland health and people's socio-economic wellbeing (i.e., people–river relationality) to contribute to shifting social and institutional practices in ways that can enhance ecosystem health and their services.
4. Develop a framework for enhancing urban river and wetland health by taking account of the systemic-relational interactions, interdependencies and potential trade-offs between ecological conditions, desired ecosystem services, and institutional and social practices.

Expertise and partners involved: The project brought together eight researchers based at Rhodes University, South Africa and Nnamdi Azikiwe University, Nigeria. These researchers were drawn from the fields of ecology, anthropology and microbiology. The key stakeholders engaged in South Africa were the Nelson Mandela Bay Metro, the Department of Water and Sanitation, and Ganesha, a local non-governmental organization. The main stakeholders in Nigeria were the Department of Environmental Assessment and the Department of Forestry, both in the Federal Ministry of Environment.

Methods applied to deliver research: The project used transdisciplinary research practice and socio-ecological system framing as the overarching methodological framework. In this regard,

workshops, community surveys, in-depth interviews and focus group discussions were the key social science methods applied. Water quality sampling, macroinvertebrate sampling, shotgun metagenomics, river habitat assessment and various multivariate and predictive statistics were the main methods applied from the natural sciences.

Results to date: Four main outcomes were achieved in South Africa. First, in partnership with ward councillors in the Nelson Mandela Bay Metro, the project established catchment champions who are undertaking river clean-up and exploring ways of using eco-tourism to generate revenue. Second, the project conducted a three-month clean-up of the Swartkops River, following which Ganesha, the NGO, began exploring ways to recycle the waste collected during the exercise. Third, recognizing the significance of the pollution in the Swartkops River, the project deployed artificial wetlands to absorb pollutants from the river system. Finally, the project initiated a multiparty process comprising the local municipality, Rhodes University, the Department of Water and Sanitation, and local communities for sustainable utilization and protection of Swartkops River resources.

In Nigeria, the project established a Joint Forum for Regulators and Users of Rivers and Wetland Resources in the Federal Capital Territory (JOFRURF). The forum was established to bridge the gaps between regulators and communities for sustainable management of rivers and wetlands within Abuja, the capital city. In both countries, the project succeeded in bringing together key governance and institutional actors that had thitherto worked in silos.

The team has secured additional funding of 45,000 Euro to continue research work in the Swartkops catchment in the city of Abuja in Nigeria and the Nelson Mandela Bay Metro in South Africa. The project

Clean-up of the Swartkops River.
Photo belongs to the project

also leveraged funding from the National Research Foundation of South Africa – Global Change (Belmont Forum) (300,000 Rand per year for two years) to scale project activities and broaden the project scope in light of SDG localization and institutionalization.

The project has produced an educational video showcasing the value of urban river systems. Three articles have been published, with another two in preparation:

- Odume, O. N., Amaka-Otchere, A., Onyima, B., Aziz, F., Kushitor, S. and Thiam, S. 2021. Pathways, contextual and cross-scale dynamics of science-policy-society interactions in transdisciplinary research in African cities. *Environmental Science & Policy*, Vol. 125, pp. 116–25. https://doi.org/10.1016/j.envsci.2021.08.014
- Thiam, S., Aziz, F., Kushitor, S. B., Amaka-Otchere, A. B. K., Onyima, B. N. and Odume, O. N. 2021. Analyzing the contributions of transdisciplinary research to the global sustainability agenda in African cities. *Sustainability Science*, Vol. 16, pp. 1923–44. https://doi.org/10.1007/s11625-021-01042-6
- Odume, O. N., Onyima, B. N., Nnadozie, C. F., Omovoh, G. O., Mmachaka, T., Omovoh, B. O., Uku, J. E., Akamagwuna, F. C. and Arimoro, F. O. 2022. Governance and institutional drivers of ecological degradation in urban river ecosystems: insights from case studies in African cities. *Sustainability*, Vol. 14, No. 21, 14147. https://doi.org/10.3390/su142114147

Team involved in river clean-up. Photo belongs to the project

22

LIRA PROJECT

Inclusive metabolism: Using co-produced theory of informal decentralized urban infrastructures to transform the delivery of urban food, water and energy services in Ghana and South Africa

This project contributes to SDG 2, SDG 8 and SDG 11

This LIRA project (2019–2021), led by **Sandra Boatemaa at Stellenbosch University, South Africa**, set out to achieve three main objectives in the project cities (Cape Town and Kumasi), namely: to examine how informal infrastructures interact to distribute food, water and energy; to identify the microbiological composition and food safety challenges associated with vegetable trading at informal markets; and to examine local solutions for addressing infrastructure challenges associated with informal food vendors.

Expertise and partners involved: The project brought together 13 researchers (three senior researchers, three Master's students and seven research assistants) based at Stellenbosch University and Kwame Nkrumah University of Science and Technology in Kumasi, Ghana. These researchers were drawn from the fields of population studies, biochemistry, microbiology, urban geography and agricultural economics. The research team engaged with stakeholders from both government and NGOs. The project's key stakeholders in Cape Town were the Resilience Unit of the City of Cape Town, ICLEI – Local Governments for Sustainability (Africa), Cape Town Together Food Growers Initiative and Facreton Primary School. The main stakeholders in Kumasi were the Ejisu and Oforikrom Municipal Assemblies, Ejisu Market Women Association and Ayigya Traders Association.

Methods applied to deliver research: The project employed a mix of natural and social science methods in conducting primary research. These included traditional research methods such as participant observation, in-depth interviews, surveys and microbiological and chemical analyses, but also more applied methods like stakeholder workshops, curated photography storytelling (with a photo competition on Instagram) and the cultivation of a school garden.

Results to date: Three notable social results have been achieved on the project. The first is the contribution of the school garden to food security and learning among the students at the Facreton Primary School. The school headmaster reported that the resident chef began including the vegetables grown in the garden in the meals. This exposure to healthy foods (primarily green leafy vegetables and herbs) from an early age will improve the students' nutritional outcomes and provide a long-term solution to malnutrition. There is also the possibility that the lessons learned from the school garden will be passed on to parents by the students, compounding the impact of the intervention.

Second is the inclusion of the prototype of the vegetable garden into the City of Cape Town's housing architecture. This is a very important development for urban planning in South Africa, as the City hopes to integrate the feature into buildings in the future to promote carbon reduction. The prototype, showcased on YouTube, has been viewed by more than 3,000 people to date. Furthermore, the Department of Transportation at Cape Town also provided bicycles to the youth group the project formed in Dunoon to support their movement and communicate information regarding COVID-19 vaccines.

Third, the findings from the project have been used to engage policy-makers to raise awareness and encourage reflection and social change on informal infrastructure and cities. For instance, based on the findings from the survey, the research team invited policy actors to reflect on the state of market facilities, the challenges of transportation and the disconnect between food and other resources (particularly energy and water) reported by informal vendors in Kumasi.

A key knowledge product generated by the project is a permanent online photo exhibition of resources in cities. This exhibition has started conversations about resources in cities and how people are connected to those resources. The project has also produced reports and policy briefs on improving food security, livelihoods and overall urban resilience through evidence-informed interventions. The project supported four Master's students who have graduated successfully. Two of the Master's students at Stellenbosch University graduated *cum laude*. In addition, three articles have been published, while another two are currently under review in academic journals:

- Kushitor, S. B., Alimohammadi, S. and Currie, P. 2022. Narrative explorations of the role of the informal food sector in food flows and sustainable transitions during the COVID-19 lockdown. *PLOS Sustainability and Transformation*, Vol. 1, No. 12, e0000038. https://doi.org/10.1371/journal.pstr.0000038
- Kushitor, S. B., Badu, M., Kushitor, M. K. and Currie, P. 2022. Access to market infrastructure and its effect on food handling and food safety among vegetable traders in an African city. *Frontiers in Sustainable Food Systems*. https://doi.org/10.3389/fsufs.2022.724190
- Langa, Z.V., Kushitor, S.B., Koen, N. and Harper, J. 2022. Exploring the development of change agents for sustainability: outcomes of the Listen, Live and Learn initiative at Stellenbosch University. *International Journal of Sustainability in Higher Education*, Vol. 23 No. 8, pp. 309–23. https://doi.org/10.1108/IJSHE-01-2022-0029

Food market in Senegal.
Photo: @kaj_graphy, Thies, Senegal

23

LIRA PROJECT

Decentralization of urban water supply services and access to water under urbanization in West Africa, Wa (Ghana) and Niamey (Niger)

This project contributes to SDG 6 and SDG 11

This LIRA project (2019–2021), led by **Emmanuel K. Derbile at the Simon Diedong (S. D.) Dombo University of Business and Integrated Development Studies, Ghana**, explored how a multi-stakeholder management approach can improve knowledge, awareness, attitudes and capacity for improving water governance and promoting inclusive access to the resource for urban populations in the cities of Wa and Niamey in West Africa.

Rapid urbanization in African countries places immense pressure on water infrastructure in cities, and city authorities often struggle to keep pace with demand. This undermines the ability of countries in the region to attain SDG 6, which is focused on ensuring the availability and sustainable management of clean water and sanitation for all. In this context, innovations for addressing the urban water challenge – in particular, decentralized systems for water supply and management – are critical.

In a departure from traditional research projects, this study was commissioned with a dual objective: first, to experiment with TD research as a means to understanding urban water governance and management landscapes in the project cities; and second, to analyse how city residents access safe water and the implications of this for urban water planning.

Expertise and partners involved: The project brought together researchers based at the S. D. Dombo University of Business and Integrated Development Studies (formerly the University for Development Studies, Wa) and Abdou Moumouni University, Niger. The research team engaged with stakeholders from the public, private and civil society sectors in both countries. The project's key stakeholders in Wa were Wa Municipal Assembly, Ghana Water Company, Land Use and Spatial Planning Authority. Community-level stakeholders included water management committees, water vendors, assemblymen and women, chiefs, religious leaders and women's groups. The main stakeholders in Niamey were the Niger Company for Water Exploitation (SEEN), the Regional Directorate of Hydraulics and Sanitation, the Environmental Protection Agency and the Municipality of Niamey's Committee for Water Management and networks of journalists covering water, sanitation and hygiene issues. The stakeholders at the community level included NGOs, sachet water factories, associations of fountain owners, autonomous water operators/ private water vendors and traditional leaders.

Methods to deliver research: The project drew on a transdisciplinary and multi-stakeholder research approach, first, to foster an integrated and holistic understanding of inequalities in access to urban water supply, and second, to facilitate co-design of policy and strategic interventions for improving water supply and access in the project contexts. The project team deployed surveys, water quality testing, key informant interviews, group interviews, focus group discussions, transect walks, observation and desk studies in conducting primary research. Stakeholder engagement was done primarily through workshops and the use of mapping techniques. The team found the focus group discussions and workshops to be most

effective in achieving the project objectives, because they created an enabling environment for open, confrontational and participatory discussions among different stakeholders.

Results to date: The results from the project are twofold. First, the study revealed the feasibility and relevance of TD as a pragmatic research methodology and a tool for understanding and planning urban water governance, management and access. This methodology was effective in promoting a multi-stakeholder approach and maximizing the participation of stakeholders in the research and planning process. Second, the results showed that decentralized systems of urban water supply management have not ensured equity in access to safe water. The study revealed both an access and a water quality problem – which poses a risk to human safety – in Wa and Niamey. In both cities, residents in the core urban zones and suburbs were found to have limited access to safe water compared with residents in low-density and government residential areas. Women and children in low-access zones were identified as the worst-hit because they bear the burden of searching for water over long distances and time periods. The study yielded a number of research reports and a policy brief on improving urban water governance and planning in sub-Saharan Africa. Publication of the research results in academic journals is in preparation.

Community engagement activities.
Photo belongs to the project

24

LIRA PROJECT

Reducing diarrhoea burden under climate change in urban contexts: An integrated approach for sustainability in West African medium-sized cities

This project contributes to SDG 3, SDG 6, SDG 11 and SDG 13

This LIRA project (2019–2021) led by **Sokhna Thiam from IRESSEF, Dakar, Senegal**, and the African Population and Health Research Center, Nairobi, Kenya, seeks to understand the interlinkages between climate change and diarrhoeal risk in urban context to improve their management and to contribute to strengthening the resilience of health systems and communities in the face of climate change. The project is implemented in two secondary cities in West Africa: Mbour (Senegal) and Korhogo (Côte d'Ivoire).

Expertise and partners involved: The project brings together academic and non-academic partners. The academic actors include experts in public health, health geography, environmental epidemiology, natural sciences, socio-anthropology, sanitary engineering and climatology. In both countries, the non-academic actors include stakeholders from national government ministries/departments and agencies, city/municipal and health authorities, as well as local NGOs and community leaders, and community health workers.

Methods applied to deliver research: Working on global challenges, such as climate change and its impacts on health and, in particular, on waterborne diseases like diarrhoea need a better understanding of both the natural and social drivers. This requires close collaboration between different academic disciplines and non-academic perspectives from different stakeholders and communities in order to co-produce knowledge, which could be translated into practice and actionable policies that reduce the disease burden and promote sustainable development.

To gain, therefore, an in-depth understanding of the interlinkage between climate change and diarrhoeal risks in the case studies, the researchers worked with stakeholders from the health sector and municipal actors as well as community co-researchers through several research methods:

- The EcoHealth approach, taking into account its various pillars including transdisciplinarity, community participation, equity and gender aspects.
- Stool sample assessment for diarrhoeal diseases cases among children under 5 years old who had diarrhoea at health facility level.
- Climate data (over a 58-year period) and health data (over a 10-year period) assessment to investigate temporal trends in temperature and rainfall and determine whether variation in diarrhoea incidence was associated with these climate factors.
- Quantitative household surveys of 664 households in 13 neighbourhoods in Mbour to assess environmental conditions.

Presentation of project results to stakeholders.
Photo belongs to the project

- Qualitative surveys with several data collection tools including documentary review, direct observations and photography, semi-structured interviews, and focus groups discussion with different actors including health and political actors, community health workers, neighbourhood leaders, local NGO leaders, women leaders and mothers/caregivers of children under 5 years old. For comparative purposes, the qualitative survey tools were similar in both cities.
- Workshops (inception workshop and reflection/knowledge sharing workshop) where researchers in each city engaged with policy-makers, community co-researchers (city/municipal and health actors), technical partners (mainly local NGOs) and community participants to discuss the preliminary results from the climate and health data assessment and to contextualize the quantitative and qualitative survey tools.

Results to date: The project contributed to building trust and increased networks, partnership and mutual relationships between researchers, stakeholders and communities at local and national level. It brought together different stakeholders and increased awareness about the links between climate change and diarrheal diseases risk in urban areas. The project also strengthened capacity of students and stakeholders on the issues of climate change and its impact on diarrheal diseases. Furthermore, the project developed recommendations for action to shed light on the criticality of multisectoral collaboration and data sharing through workshops to break institutional silos, and the need to integrate biophysical data on climate change and incidences of diarrhoea with social data on values and perceptions of the key drivers of diarrhoea in an urban context.

To date, the project has contributed to the development of the following knowledge products:

- Thiam, S., Aziz, F., Kushitor, S. B., Amaka-Otchere, A. B. K., Onyima, B. N. and Odume, O. N. 2021. Analyzing the contributions of transdisciplinary research to the global sustainability agenda in African cities. *Sustainability Science,* Vol. 16, pp. 1923–44. https://doi.org/10.1007/s11625-021-01042-6

- Odume, O. N., Amaka-Otchere, A., Onyima, B., Aziz, F., Kushitor, S. and Thiam, S. 2021. Pathways, contextual and cross-scale dynamics of science-policy-society interactions in transdisciplinary research in African cities. *Environmental Science & Policy*, Vol. 125, pp. 116–25. https://doi.org/10.1016/j.envsci.2021.08.014
- NASAC. 2022. *Protecting Human Health against Climate Change in Africa* (Caussy, D., ed). Network of African Science Academies (NASAC) and InterAcademy Partnership (IAP). ISBN 979-8-9859206-1-1. www.interacademies.org/publication/protecting-human-health-against-climate-change-africa

More academic papers and policy briefs are currently under development. The PI was invited as a discussant at the Africa Climate Week side event *"Developing and using the scientific evidence base for tackling challenges of climate change for human health"* organized by NASAC. The PI was also invited as a partner/expert on climate change, health, energy and transdisciplinary co-design approaches in "Co-creating Climate Services for Care Economy and Carrying Society" (CoCareSociety), a 5-year project (2022–2027) led by the Climate Service Center Germany (GERICS) and funded by the German Federal Ministry of Education and Research. Here the PI will bring in her network from Africa to support CoCareSociety, build on her LIRA expertise and experience from 2018–2021, and continue to develop her focus on the health–climate–energy nexus for future ageing society for the Least Developed Countries in Africa.

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LIRA PROJECT

Urban water futures: Bridging supply-demand gaps in Accra (Ghana) and Johannesburg (South Africa) through reuse

This project contributes to SDG 6 and SDG 11

This LIRA project (2019–2021) led by **Anita Etale at University of the Witwatersrand, South Africa**, sought to answer the question of whether, and how, water reuse can address existing demand-supply gaps for water in Accra and Johannesburg. Approximately 1 billion people will be living in cities with perennial water shortage by 2050. One proposed strategy for meeting future water demand is water reuse. Water reuse involves treating wastewater and using it either directly or indirectly. Direct potable reuse has the advantage of minimizing losses to the environment and shortening the treatment chain. However, despite advances in treatment technology and assurances by water utilities, direct reuse faces barriers – primarily, negative public perceptions regarding possible health risks.

It is important that proposals for reuse address these perceptions in order to ensure successful planning and implementation, as this project aimed to do. By delineating criteria for acceptance of reclaimed water from a risk paradigm, the project identified the acceptability of reclaimed water for various uses as a first step to sustainable and demand-driven use of reclaimed water in the two project cities. The specific objectives of the project were: to determine acceptable uses of reclaimed water amongst residents of Accra and Johannesburg; to determine possible 'outrage' factors underlying the risk perceptions of reclaimed water amongst those residents; and to determine the possible role of norms in influencing residents' acceptance of water reuse and their perceptions of the risks involved.

Expertise and partners involved: The project brought together a team of researchers (comprising senior researchers and postgraduate research assistants) based at the University of the Witswatersrand. These academics were drawn from the fields of water reuse, nanotechnology, public risk perception and communication, and the social sciences. The research team engaged with a range of stakeholders from the public, private and civil society sectors. The key stakeholders in Johannesburg were the Johannesburg City Council, Department of Water Affairs, Rand Water, Radio 702, Vaal Water Users Association, Gender CC and Johannesburg Chamber of Commerce. The stakeholders in Accra were the Accra Metropolitan Assembly, Ghana Water Company Limited, Water Research Institute and Women of Dignity.

Methods applied to deliver research: The study employed a transdisciplinary approach in which relevant stakeholders were involved in problem definition right from the proposal development stages. The methods used by the research team included interviews, focus groups and surveys. The data generated through these means were analysed and discussed with water users, regulators, service providers and other stakeholders via interactive engagement platforms (both in-person and online).

Results to date: In Ghana, the engagement process provided a platform for stakeholders to discuss various issues related to urban water in Accra in an egalitarian manner. Importantly, engagement on the project led to direct interactions between water users and service providers which, in turn,

yielded practical action aimed at resolving the challenges of contamination and irregularity of water supply in the city.

The project results in South Africa showed that, in contrast to accepted theories about the effect of information provision on behaviour, it is possible to influence public perception and acceptance of reclaimed water by providing information to consumers in a systematic manner. In a manuscript currently under review, the research team shows how, by initiating deliberative thinking processes in which respondents engaged with aspects of various alternative water sources, up to 66 percent of respondents initially opposed to the use of recycled water at the beginning of the survey were willing to use it for various purposes (including drinking) after the project provided information on the treatment process.

Two articles have been published:

- Prins, F. X., Etale, A., Dziwornu, A. and Thatcher, A. 2022. Water scarcity and alternative water sources in South Africa: can information provision shift perceptions? *Urban Water Journal.* https://doi.org/10.1080/1573062X.2022.2026984
- Ablo, A. D. and Etale, A. 2022. Beyond technical: delineating factors influencing recycled water acceptability. *Urban Water Journal.* https://doi.org/10.1080/1573062X.2022.2155847

The following manuscript from the project are currently undergoing peer review:

- Household access and expenditure on water: the urban political ecology of water inequality in Accra, Ghana.

ANNEX 2: ARTICLES PUBLISHED TO DATE THAT INVOLVE LIRA RESEARCHERS

Below is the list of articles that have been published to date with the contribution of LIRA researchers. A number of manuscripts have been submitted for review and are yet to be published.

1. Ablo, A. D. and Etale, A. 2022. Beyond technical: delineating factors influencing recycled water acceptability. *Urban Water Journal*. https://doi.org/10.1080/1573062X.2022.2155847
2. Ambole, A. 2020. Embedding design in transdisciplinary research: perspectives from urban Africa. *Design Issues*, Vol. 36, No. 2, pp. 28–40. https://doi.org/10.1162/desi_a_00588
3. Ambole, A., Koranteng, K., Njoroge, P. and Luhangala, D. L. 2021. A review of energy communities in sub-Saharan Africa as a transition pathway to energy democracy. *Sustainability*, Vol. 13, No. 4. https://doi.org/10.3390/su13042128
4. Ambole, A., Musango, J. K., Buyana, K., Ogot, M., Anditi, C., Mwau, B., Kovacic, Z., Smit, S., Lwasa, S., Nsangi, G., Sseviiri, H. and Brent, A. C. 2019. Mediating household energy transitions through co-design in urban Kenya, Uganda and South Africa. *Energy Research & Social Science*, Vol. 55, pp. 208–17. https://doi.org/10.1016/j.erss.2019.05.009
5. Antwi-Agyei, P., Dwumfour-Asare, B., Adjei, K. A., Kweyu, R. and Simiyu, S. 2020. Understanding the barriers and opportunities for effective management of shared sanitation in low-income settlements – the case of Kumasi, Ghana. *International Journal of Environmental Research and Public Health*, Vol. 17, No. 12. https://doi.org/10.3390/ijerph17124528
6. Antwi-Agyei, P., Monney, I., Adjei, K. A., Kweyu, R. and Simiyu, S. 2022. Shared but clean household toilets: what makes this possible? Evidence from Ghana and Kenya. *International Journal of Environmental Research and Public Health*, Vol. 19, No. 7. https://doi.org/10.3390/ijerph19074271
7. Bloem, S., Swilling, M. and Koranteng, K. 2021. Taking energy democracy to the streets: socio-technical learning, institutional dynamism, and integration in South African community energy projects. *Energy Research & Social Science*, Vol. 72. https://doi.org/10.1016/j.erss.2020.101906
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11. Buyana, K., Byarugaba, D., Sseviiri, H., Nsangi, G. and Kasaija, P. 2019. Experimentation in an African neighborhood: reflections for transitions to sustainable energy in cities. *Urban Forum*, Vol. 30, No. 2, pp. 191–204. https://doi.org/10.1007/s12132-018-9358-z
12. Buyana, K., Lwasa, S. and Kasaija, P. 2019. Gender ideologies and climate risk: how is the connection linked to sustainability in an African city? *International Journal of Social Ecology and Sustainable Development*, Vol. 10, No. 1, pp. 16–30. https://doi.org/10.4018/IJSESD.2019010102
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