

Exploring the potential of using bio briquette ash in building materials
Supplementary material

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African Centre for Sustainable Cities Studies

Proceedings of the African Conference on Resilient and Sustainable Cities

26 - 27 February, 2025

APC, Bunju, Dar es Salaam, Tanzania

Editors:

Ally Namangaya
Deodatus Shayo
Michael Coto
Oswald Devisch
Shadrack Sabai

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Conference Theme:

***Novel Approaches for Development of Resilient and Sustainable
Cities in Africa***

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Message from the Vice-Chancellor of Ardhi University

It is my great honor to invite you to delve into the *Proceedings of the African Conference on Resilient and Sustainable Cities*. Within these proceedings, you will discover a rich collection of insights, research findings and innovative practices presented by leading scholars, researchers and practitioners from across Africa and beyond. Together, these works reflect a shared commitment to addressing some of the most pressing challenges facing our cities today.

As urbanization continue to accelerate across the continent, African cities find themselves at a pivotal crossroads. Rapid growth brings unprecedented opportunities for economic development and social transformation. However, it also exacerbates vulnerabilities related to climate change, infrastructure deficits, informal settlements, and resource management. Cities such as Dar es Salaam, which is steadily advancing toward megacity status, illustrate both the promise and the complexity of urban development in our region. This reality underscores the urgent need for bold, evidence-based solutions that are inclusive, adaptive and sustainable.

The contributions gathered in this volume respond directly to these challenges. Organised around four thematic tracks- Innovative Digital Technologies, Knowledge Systems, Resource Management, and Participation and Governance—showcase novel approaches and practical strategies for building resilient urban futures. Whether addressing the potential of smart cities, the importance of data-driven governance, or the critical role of community engagement, the works presented here aim to inform policy decisions and inspire actionable change at all levels.

As you engage with these conference proceedings, I encourage you to reflect on how the knowledge and solutions shared here can be applied within your own cities, institutions and communities. May this collection serve not only as a documentation of our discussions, but also as a catalyst to sustained collaboration in pursuit of sustainable urban development across Africa.

Finally, I would like to express my sincere gratitude to the partners who have made this conference and its proceedings possible. We thank the Government of Belgium, through the Flemish Interuniversity Council – University Development Cooperation (VLIR-UOS), and the Royal Academy of Engineering for their invaluable support and contributions. It is through such partnerships that we are able to advance research, support innovation and strengthen the capacity of our cities to thrive in the face of future challenges.

Thank you for your engagement and your commitment to building resilient and sustainable cities. I wish you insightful reading and productive application of the knowledge shared in these *Proceedings of the African Conference on Resilient and Sustainable Cities*.

Prof. Evaristo Liwa, Vice Chancellor, Ardhi University, Tanzania



Message from the Rector of UHasselt for the IUC Conference Proceedings

Over the past few years, I have heard many great things about Ardhi University and its VLIRUOS IUC partnership with Hasselt University. It is inspiring to witness firsthand the impactful work being done here and to meet the dedicated individuals behind it.

At Hasselt University, our mission extends beyond borders. We exist to serve our local community while fostering global impact through meaningful collaborations. Our partnership with Ardhi University is a testament to this commitment. Global partnerships like this one yield impressive research results, high-quality doctoral training, and valuable opportunities for staff and student mobility. More importantly, they allow us to tackle complex societal challenges—urban resilience, sustainable resource management, inclusivity, and more—through a multidisciplinary and collaborative approach.

This programme is only eighteen months underway, yet we have already achieved significant milestones. From establishing master exchange programmes to building a recycling centre in Kigamboni and creating nineteen PhD positions (most as joint PhDs with Flemish universities), we have successfully moved from paper to reality, from words to action.

None of this would have been possible without the dedication and commitment of our partners. I extend my sincere gratitude to Ardhi University for its warm hospitality and strong engagement in this collaboration. A special thanks to our IUC project coordinators, Professor Gabriel Kassenga and Professor Emeritus Rob Cuyvers, whose leadership and vision have guided this partnership through its challenges and successes.

I also wish to acknowledge the invaluable contributions of our partners—Flemish universities and university colleges (KU Leuven, UGent, VUB, UAntwerpen, Hogeschool PXL, and AP Hogeschool Antwerpen), Tanzanian and East African universities (Ardhi, Mzumbe, Mbeya), the Belgian Development Agency Enabel, Belgium's Embassy in Dar es Salaam, local governments, communities, and NGOs. Each of these partners plays a crucial role in our shared goal: building the African Centre for Sustainable Cities Studies and fostering inclusive, safe, resilient, and viable communities.

Finally, I express my gratitude to Belgium's Directorate-General for Development Cooperation and Humanitarian Aid, as well as the VLIRUOS framework, for their essential support in enabling higher education institutions in Belgium and academics worldwide to engage in long-term scientific collaboration.

This conference provides a vital platform to discuss urgent global challenges—from urban transport to gender equity to emerging technologies. While we come from different backgrounds and disciplines, we are united by a shared commitment to building a more resilient, equitable, and sustainable future. May this conference not only serve as an exchange of ideas but also as a catalyst for action, strengthening our partnership and paving the way for impactful solutions that extend far beyond these proceedings.

– Prof. dr. Bernard Vanheusden, Rector UHasselt, Belgium

Editorial Message

Welcome to the Proceedings of the African Conference on Resilient and Sustainable Cities.

This conference offers a valuable opportunity to share knowledge, exchange ideas and explore innovative solutions for our cities. It is our pleasure to invite you to read the *Proceedings of the African Conference on Resilient and Sustainable Cities* and to engage with the inspiring work presented across the four general tracks.

Innovative Digital Technologies track, provides a diverse range of contributions that demonstrate how technology is transforming urban life. These papers explore digital tools designed to preserve collective memory, offering new ways for communities to document and share their histories. Others examine how emerging technologies are reshaping transport logistics and supply chain systems in growing cities like Dar es Salaam, improving efficiency and resilience. Within this track papers, you will also find practical insights on engaging stakeholders through digital platforms to support sustainable infrastructure development, as well as the use of technology to facilitate conflict resolution in rural settings. Innovative governance frameworks for smart cities are explored, with particular focus on approaches tailored for East African contexts, alongside work highlighting the importance of youth participation in smart city initiatives. Other contributions address critical urban challenges, from improving financial inclusion and gender equality to applying geospatial data for mapping urban growth. You will also find studies on leveraging ICT to enhance water and sanitation services, promoting road safety, and using Internet of Things (IoT) solutions to ensure access to safe drinking water.

Knowledge Systems track offers a diverse collection of studies that demonstrate the critical role of knowledge—both traditional and contemporary—in shaping the future of Africa's cities, food systems, heritage and education. The contributions presented explore how agricultural practices and mechanization are influencing land tenure systems, particularly in regions balancing customary land rights with modern demands. Other papers provide valuable insights into the governance of urban and peri-urban food systems, highlighting the experiences of small-scale farmers and the role of informal markets in ensuring access to nutritious foods, especially on the growing edges of our cities. This track also reflects on the challenges of urbanization through the lens of mobility and public transport behavior, spatial analyses of food environments, and the ongoing efforts to improve accessibility through pedestrian-centered urban design. Readers will find thoughtful examinations of the intersection between urban resilience and education, including how higher education can support crisis recovery and how indigenous knowledge and heritage are being integrated into architecture curricula. The papers sheds light on the protection of cultural heritage in rapidly growing cities, emphasizing the roles of both public and private actors in safeguarding historical landscapes.

Resource Management track presents a rich and diverse body of work that reflects the urgency and creativity of resource management solutions in African cities, where sustainable approaches to energy, water, waste and sanitation are critical to urban resilience. The papers in this track offer compelling innovations in renewable energy, from solar-powered cooking technologies advancing clean cooking practices to biogas purification systems designed to serve rural areas. There are practical insights on optimizing waste streams, including municipal solid waste and kitchen refuse, to enhance biogas production and support circular economies through biofertilizer and briquette applications. Beyond energy generation, research has

explored the transformative use of byproducts, such as bio-briquette ash, in construction materials. Water resource management is another key theme, with studies addressing the potential of rainwater harvesting in semi-arid regions, solar-powered kiosks for community water access, and advanced materials for treating fluoride-contaminated water. Innovative sanitation models are also highlighted, offering strategies to manage faecal sludge, promote hygiene, and improve manual emptying services in high-density neighborhoods. Urban resilience is further reinforced through studies that assess the environmental impact of sand quarrying on water sources, explore organizational challenges faced by water utilities, and investigate how construction industries contribute to economic stability.

Participation and Governance track present the vital role of inclusive engagement and shared decision-making in building resilient and sustainable cities. The track brings forward diverse experiences from across Africa, showing how cities are reimagining urban development beyond large-scale projects by embracing regenerative approaches that prioritize local needs. Alternative models are presented, where incremental, co-produced neighborhoods and the active involvement of communities are shaping new urban futures, particularly in rapidly growing regions. Papers on managing public spaces, land subdivision in informal settlements, and entrepreneurship in peri-urban areas further highlight the complexities of governance, calling attention to how everyday practices can either reinforce or disrupt systems of inequality. In rapidly urbanizing contexts, participatory mapping and locally led planning are proving to be essential tools to better understand and respond to the dynamic nature of urban life. The track also explores how spatial change around resource-rich areas impacts communities and governance structures, and how better housing, infrastructure and design can contribute to public health and safety. Beyond the physical environment, powerful contributions address social dimensions of participation, from creating inclusive education policies to challenging the silence around gender-based violence and supporting community-led monitoring efforts.

Enjoy reading the *Proceedings of the African Conference on Resilient and Sustainable Cities*, and discover innovative ideas shaping our future cities!

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Ally Namangaya, Deodatus Shayo, Michael Coto, Oswald Devisch and Shadrack Sabai

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