

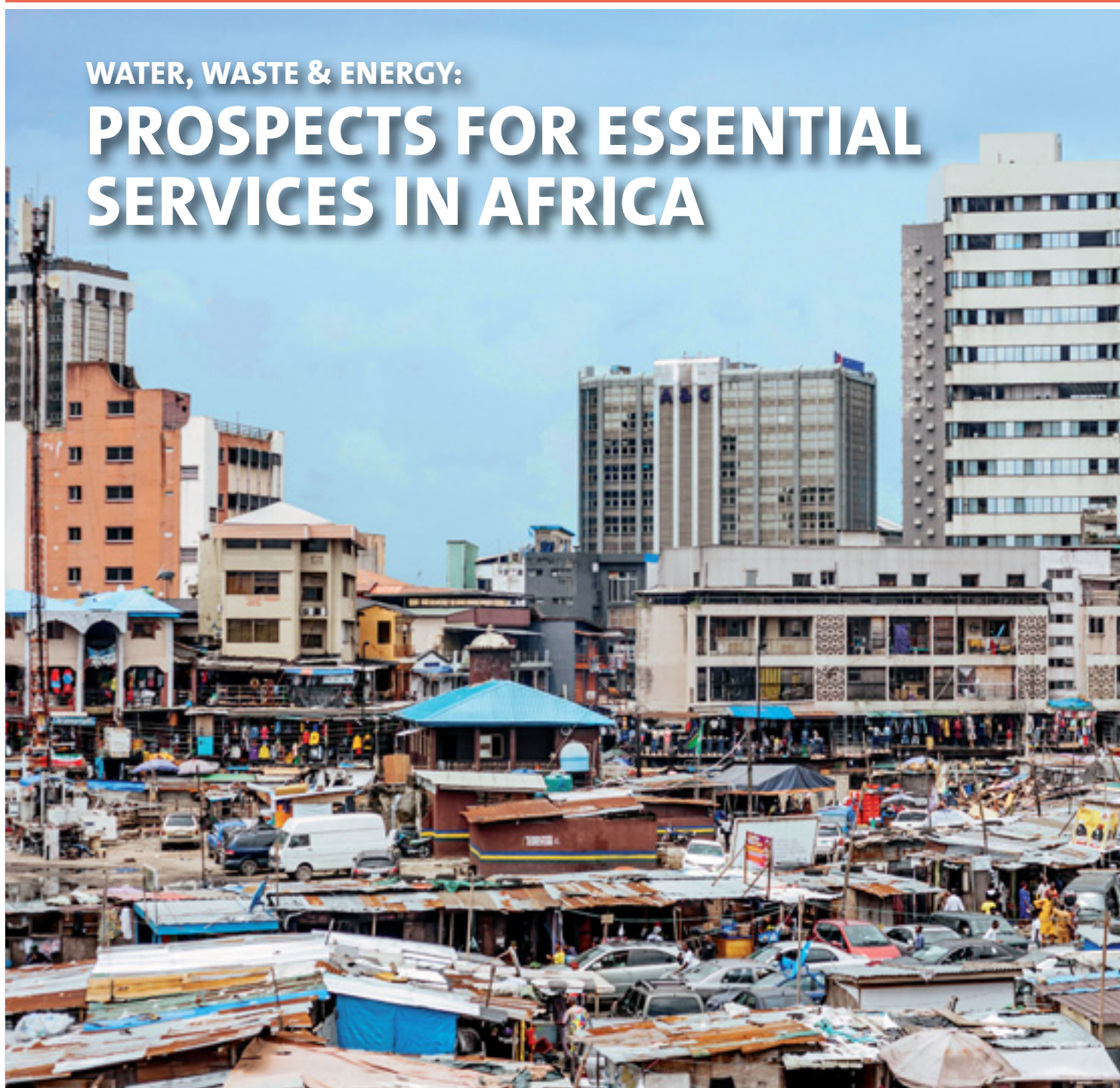
THE VEOLIA INSTITUTE REVIEW

FACTS REPORTS

2021

WATER, WASTE & ENERGY:

PROSPECTS FOR ESSENTIAL SERVICES IN AFRICA



In partnership with
Archipel&Co.

THINKING TOGETHER TO ILLUMINATE THE FUTURE

THE VEOLIA INSTITUTE

Designed as a platform for discussion and collective thinking, the Veolia Institute has been exploring the future at the crossroads between society and the environment since it was set up in 2001. Its mission is to think together to illuminate the future.

Working with the global academic community, it facilitates multi-stakeholder analysis to explore emerging trends, particularly the environmental and societal challenges of the coming decades. It focuses on a wide range of issues related to the future of urban living as well as sustainable production and consumption (cities, urban services, environment, energy, health, agriculture, etc.).

Over the years, the Veolia Institute has built up a high-level international network of academic and scientific experts, universities and research bodies, policymakers, NGOs and international organizations. The Institute pursues its mission through publications and conferences, as well as foresight working groups.

Internationally recognized as a legitimate platform for exploring global issues, the Veolia Institute has official NGO observer status under the terms of the United Nations Framework Convention on climate change.

THE FORESIGHT COMMITTEE

Drawing on the expertise and international reputation of its members, the Foresight Committee guides the work of the Veolia Institute and steers its development.

The current members of the Foresight Committee are: **Harvey Fineberg**, President of the Gordon and Betty Moore Foundation and former President of the American Institute of Medicine; **Pierre-Marc Johnson**, international lawyer and former Premier of Quebec; **Philippe Kourilsky**, Honorary Director General of the Pasteur Institute; **Amy Luers**, Global Lead Sustainability Sciences at Microsoft; **Mamphela Ramphela**, former Managing Director of the World Bank and **Amartya Sen**, Nobel Prize-winning economist and Professor at Harvard University.

THE REVIEW

The Veolia Institute Review - FACTS Reports is an international publication compiling diverse perspectives on topics at the crossroads between society and the environment.

The review was launched in 2007 with the aim of sharing best practices from the field, to help find solutions to problems in the economy, development, healthcare, environment, agriculture and education, in both developing and developed countries.

The interdisciplinary review is a vehicle for sharing the experiences and expertise of different stakeholders (researchers, academic experts, policymakers, companies, NGOs, international organizations, etc.), with the aim of taking advantage of a diversity of perspectives on a given topic, by combining feedback on best practices from the field and expert analysis.

*Issue coordinated by
Mathilde Martin-Moreau
& David Ménascé,
Archipel&Co.*

CONTENTS

P. 2

FOREWORD

Mamphela Ramphela

Reimagine SA, Club of Rome

P. 3

INTRODUCTION

Nicolas Renard

Veolia Institute

P. 4

Access to essential services: key figures and progress on the African continent

Mathilde Martin-Moreau, David Ménascé

Archipel&Co

1. Heading towards 2030: outlook and challenges for essential services in Africa

P. 10

Brakes and levers for the development of essential services in Africa

Dr. Ibrahim Assane Mayaki

African Union Development Agency

P. 14

How can Africa's water companies boost their resilience when facing health crises?

Fadel Ndaw

World Bank

P. 18

Africapolis: understanding the dynamics of urbanization in Africa

Philipp Heinrigs

Sahel and West Africa Club Secretariat (SWAC), Organization for Economic Co-operation and Development (OECD)

P. 24

The quest for efficient waste management architecture in Ghana

Martin Oteng-Ababio

University of Ghana

P. 30

The toilet: unmentionable humanitarian object or luxury good?

Tatiana Thieme

University College London

Justin De Koszmowsky

Archipel&Co

P. 34

Water governance in a context of scarcity

Pr. Houria Tazi Sadeq

Coalition Marocaine pour l'Eau

P. 40

African smart cities in 2030

Sénamé Koffi Agbodjinou

HubCité project

2. High-potential innovations for a fast-changing continent

P. 46

Voicing the urban poor: experience from an energy justice program for and by slum dwellers

David Sheridan

Slum Dwellers International

Mwaura Njogu

Consultant

Andrew Maki

Justice & Empowerment Initiatives (JEI)

Frederick Agyemang

EJP Ghana

P. 52

Planning and managing Africa's cities: what place for technology innovations?

Guillaume Josse

Groupe Huit, Wexity-Logiroad

P. 58

Decentralized electricity solutions: innovation in essential services is no substitute for policy

Sylvy Jaglin

Université Gustave Eiffel

Emmanuelle Guillou

LATTS

P. 64

Wastewater reuse: a solution with a future

Christophe Maquet

Veolia

P. 70

rePATRN: experience with informal waste pickers in Ghana

Jeffrey Provencal

rePATRN

P. 72

Unlocking the circular economy potential to tackle the sanitation challenge

Louise Couder,

Sheila Kibuthu

Sanergy

P. 78

Smart meters: innovating to improve water supply in a post-Covid context

Sam Drabble,

Rosemary Campbell,

Philip Oyamo,

Rosie Renouf

WSUP

3. Conditions needed for scaling up successfully

P. 84

New models for financing essential services

Jean-Michel SEVERINO

Investisseurs & Partenaires

P. 88

Improving the user experience: a powerful lever to improve sanitation practices in low-income communities

Bérangère

Magarinos-Ruchat

Firmenich

Maureen Ravily

Archipel&Co

P. 96

Consumer education can lead to behaviour change

Gordon Achola

EXP agency

Nana Asamoah-Manu

IFC

Younès Drici Tani

Non-affiliated environmental activist

Andrea Weiss

WWF South Africa

P. 104

Why accelerating partnerships in the Sanitation Economy really matters

Erin McCusker

Toilet Board Coalition, SATO (Lixil)

P. 108

Measuring the impact of decentralized electricity projects: a triangulation approach

Jean-Claude Berthelemy

University Paris 1, FERDI

P. 116

Digital solutions to improve basic service provision to the urban poor

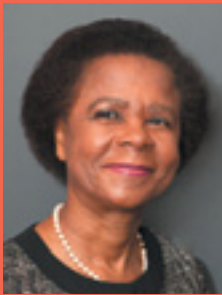
George Kibala Bauer

Mobile for Development Utilities programme, GSMA

FOREWORD

Mamphela Ramphela -

Co-founder of the ReimagineSA initiative, Co-President of the Club of Rome
Former Chancellor of the University of Cape Town, former Managing Director of the World Bank
Member of the Veolia Institute Foresight Committee



The COVID-19 pandemic aftermath allows us an opportunity to reimagine Africa's cities, towns and villages to create more ecologically sound human settlements. Africa's chaotic cities and towns are relics of colonial social engineering not fit for purpose in the 21st century. The city architecture reflects deliberate distancing of the centre and the periphery. The centre as the locus

of power and privilege for colonial elites is distinguished by the best amenities and public services, whilst the periphery inhabited by the majority of poor people is characterised by a neglect of essential basic infrastructure.

The mushrooming of townships and shantytowns across the African continent over the last five decades reflects the dismal failure of post-colonial governments and private sector actors to reimagine these dysfunctional cities and towns as spaces of dignified human settlements. The COVID-19 pandemic laid bare the gross inequities of access to essential infrastructure critical to effective public health responses. Social distancing, washing hands frequently with soap, and wearing masks were luxuries out of reach of most people in the peripheries of Africa's cities.

Reimagining post-colonial African cities and towns requires shedding of colonial mindsets and legacies. We need to imagine what a 21st century African city, town and village should look like. Reimagined smart ecologically sound human settlements need to provide platforms for innovative sustainable essential public services.

Such cities need to restore the dignity of citizens to unleash their talents and innovative energies to take ownership of shaping the futures they desire. Investments in processes to enable people who are often treated as subjects, to liberate themselves to become critically thinking citizens, is essential. Sustainable cities need active citizens to demand their rights to equitable basic services and to assume their responsibilities to be good stewards of their neighbourhoods.

A fundamental shift in mindset is needed to put human beingness - Ubuntu - back at the centre of governance. Ubuntu based governance promotes participatory democracy and promotes collaboration in the stewardship of the commons. The "I am because you are" is an attitude of mind that affirms human beings inextricable links to one another, and to the web of life. Human beings are wired for interdependence and interconnectedness to secure wellbeing for all and of our planet.

Good neighbourliness is not only about social and physical proximity but empathetic connectedness in good and bad times. COVID-19 has in many cases brought out the best in us. People reached out to neighbours and those vulnerable to support them and ensure their wellbeing. The virus opened our eyes anew to the fact that wellbeing for a few is wellbeing for none. Wellbeing is a shared status and responsibility. Securing safety and wellbeing of our neighbourhoods harkens back to the ancient wisdom of Africa that one should always enquire about the wellbeing of others to ensure wellbeing for all.

Post-COVID reconstruction and development gives Africa an opportunity to celebrate the resilience of its people despite the pre-existing conditions (poverty, inequality and unemployment), that made the continent most vulnerable. The resilience of Africa's people that has surprised many, including scientists, may well lie in the endowments of our ancient genes. Genetic endowments that enabled humanity's evolution in tough ecosystems aeons ago, are yet to be fully understood.

Ancient wisdom, science and technology in architecture, materials engineering, use of local materials to build sustainable human settlements, offer opportunities to harvest Africa's natural capital. Cities, towns and villages need to be nested in the vast tracts of land that enable smooth transitions between wilderness and residential areas to create harmony between human settlements and sensitive ecosystems. Sustainable agriculture with food baskets on the edges of cities need to be nurtured to enhance the wellbeing of people and the planet.

The African continent's new beginnings would benefit from being set on ancient foundations. Leveraging the hitherto unacknowledged indigenous knowledge, long history of science and technology is the best path forward for this ancient continent. Africa has for too long not heeded the Shona proverb that – those who wear other people's clothes, remain naked. It is time for Africa reimagine its cities, towns and villages into authentic spaces that showcase the beauty and creativity of its own architecture and materials engineering.

This issue of FACTS explores the huge opportunities offered by the much needed infrastructure investments to provide equitable access to essential public services to restore the dignity of all citizens. Understanding obstacles to past developments, harvesting innovations and technology solutions in resource constrained environments, are essential to successful sustainable interventions. It is a feast.

INTRODUCTION

Nicolas Renard - Executive Director, Veolia Institute



Obvious to some and a truth hidden from others – Africa is a hotbed of innovation. It is rich in energy resources, fertile lands and mineral reserves vital to 21st century technologies. But above all, Africa is rich in the talents of its people and their ability to create and innovate, particularly for providing access to essential services to as many people as possible. Yet despite

massive strides over the past 20 years, access for all to safe drinking water, sanitation, electricity, waste management systems, etc., continues to be one of the continent's pivotal challenges. This applies as much to far-flung villages with no public services as to cities that, temporarily overwhelmed by exploding population numbers, are losing the never-ending battle to provide basic infrastructure.

Africa has myriad facets. It is home to endless innovations for delivering services needed for day-to-day life to everybody, making them more reliable and efficient. These are hybrid innovations straddling the technical, financial and social spheres. They are concrete, often developed from the ground up, created from incremental progress that can spawn disruptive breakthroughs.

But, all too often, a portion of these innovations fail to attract attention. Why is this? Because, despite ushering in genuine progress, many of them are low profile and discreet. Because they are often more low tech than media-friendly high tech. Because, owing to disparate contexts and fragmented markets, they are not yet widespread.

Yet, for those with eyes to see, Africa is a fabulous center of invention and experimentation. Recent years have witnessed the emergence of countless fablabs working on waste recycling, energy, mobility, and so on. But Africa's greatest laboratory is in the field! Grassroots innovations are primarily technological and social. Taking electricity supplies as an example, there are multiple alternatives to conventional models; they include energy kiosks, ready-to-use home solar kits, micro grids, etc. Innovations can equally be commercial and contractual, with the unarguable success of prepaid, pay-per-use and pay-as-you-go models, all tailor-made to reflect amounts that people with low incomes can afford.

These innovations pave the way for a broad palette of proven solutions in the formal and informal sectors alike. Formal sector services can be adapted, for example to implement

novel policies for affordable connections or water recycling to combat water shortages. Informal sector services consolidate and become more professional, metamorphosing into lasting business models. Informal does not equate to irrational, simply to an alternative form of rationality, one that is powerful albeit less visible – in other words, the formal sector cannot claim a monopoly on social and economic rationality. This dialectic between formal and informal, so pressing in Africa, is an extension of that between center and periphery.

Nevertheless, simply juxtaposing innovations, however exciting they may be, does not constitute a strategy for accessing essential services. Most public policies founder on issues surrounding hybridization of solutions that are worth pursuing but highly disparate. After all, universal access to essential services is predicated on the efficient combination of individual and collective services, low cost and high cost, informal and formal systems.

Irrespective of issues surrounding extensions to systems for the supply of water and energy, managing waste or transportation, etc., the challenges that Africa must rise to are numerous and interlinked: mushrooming urban population growth is radically changing the face of the continent's urban framework; many lives continue to be blighted by malnutrition and poverty; every year some 30 million young people enter the labor market in need of training; the need to boost agricultural output to feed a fast-growing population; energy supply, fundamental to all forms of development; the painful impacts of the climate emergency, etc.; not to mention fallout from the COVID-19 crisis.

A continent of extremes, of possibles, of the future. The future of Africa – or the Africas to be more exact, such are the extremes of contrasts between its regions – will be conditioned by its innovations, and by their success and spread. The path to innovation is littered with obstacles, none more so than to their widespread rollout. This is why suitable governance and financing systems are so important, providing innovators with committed and on-going support at every stage of the innovation process, even when they fail, because “the vain effort furthers the successful.”¹ Africa is without doubt facing many challenges, but so too is it a fertile hotbed of innovation. The task now facing the continent is to foster widespread rollout of its promising innovations.

*Africa has myriad facets.
It is home to endless
innovations for delivering
services needed for day-to-day
life to everybody, making them
more reliable and efficient.*

¹ Antoine de Saint-Exupéry, *The Wisdom of the Sands* (Citadelle)

Access to essential services: key figures and progress on the African continent

Mathilde Martin-Moreau, David Ménascé, Archipel&Co - Issue coordinators



In recent years, many areas of Africa have seen progress in closing the gap in terms of access to essential services in water, sanitation, energy and waste management. But provision remains sadly insufficient to provide for most of people's needs against a background of unparalleled population growth.

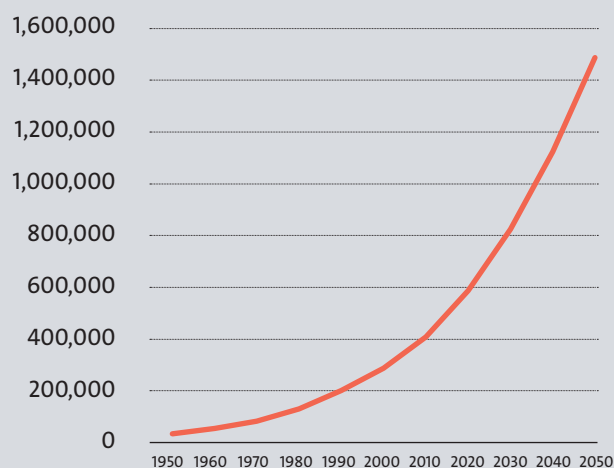
The Sustainable Development Goals set out ambitious new targets for each of these extremely interdependent services.

- Goal 6 addresses access to both clean water and sanitation. Goal 6.1 covers universal and equitable access to safe and affordable drinking water for all, and Goal 6.2 includes achieving access to adequate and equitable sanitation and hygiene for all with, in particular, an end to open defecation.
- Goal 7 asks signatories to ensure universal access to affordable, reliable and modern energy services, with an increase of renewable energy in the global energy mix.
- Lastly, the question of waste is addressed in Goal 11 (sustainable cities and communities) in terms of management and in Goal 12 (responsible consumption and production) in terms of cutting overall volumes.

1.5 BILLION CITY-DWELLERS ON THE CONTINENT BY 2050

Africa has more young people than any other continent, and is experiencing the most rapid population growth of any region of the world. The continent's population is set to double by 2050. This phenomenon impacts its cities in particular, as this is where most population growth is centered. By 2050, almost 1.5 billion Africans – over half of all its people – will live in cities, compared with fewer than 500 million in 2015.¹ This fast-growing urban population poses massive challenges in terms of urban infrastructure and access to essential services.

Urban population (in thousands) on the African continent, 1950 to 2050



Source: United Nations, World Urbanization Prospects, the 2018 Revision

ACCESS TO WATER IN AFRICA HAS IMPROVED OVER THE PAST 20 YEARS

Access to clean water, designated a fundamental right by the United Nations in July 2010, has for many years been a key component of national and international policy agendas. In Africa, the portion of people with access to at least a basic service – purpose-built water supply points such as protected wells, boreholes or standpipes – rose from around 50% in 2000 to over 60% in 2017. Despite this progress, there remains an enormous amount of work to accomplish. Worldwide, one in two people without access to basic water services currently live in Africa.² But there

¹ United Nations, World Urbanization Prospects, 2018 revision

² AFD, Atlas de l'Afrique, 2020

are, of course, disparities between the continent's various regions. In total, 37% of the African population has access to sufficient clean water in the home.³ This rises to 88% of the population in North Africa, 44% in southern Africa, 22% in East Africa, and just 16% in central Africa.⁴

SLOWER PROGRESS IN SANITATION

Sanitation services have long been the poor relation of policies for accessing essential services. The 2000 Millennium Development Goals made little mention of sanitation as a discrete topic. Today, less than 20% of

Africans have access to safely managed sanitation systems and the proportion of people with access to basic toilet installations rose only from 28% to 33% in the years 2000-2017. But again there are substantial regional disparities. In 2017, close to 68% of the population in North Africa had access to sanitation systems, compared to 25% in southern Africa, 2.1% in East Africa, and just 1.7% in central Africa.⁵

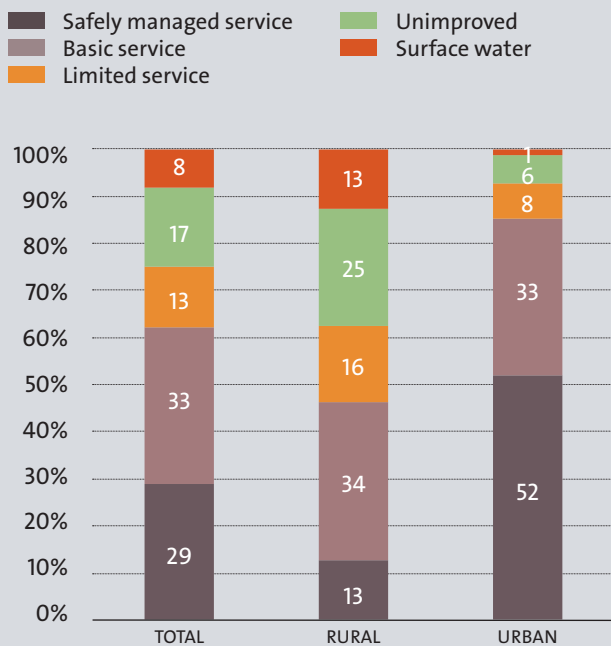
There are also considerable disparities between urban and rural areas: most people in rural areas practice open defecation in the absence of any suitable alternatives.

³ UNICEF and World Health Organisation, 2019

⁴ UNICEF and World Health Organisation, 2019

⁵ UNICEF and World Health Organisation, 2019

Access to drinking water in Africa (2017)



DRINKING WATER LADDER

Safely Managed: Drinking water from an improved water source which is located on premises, available when needed and free from faecal and priority chemical contamination

Basic: Drinking water from an improved source, provided collection time is not more than 30 minutes for a roundtrip including queuing

Limited: Drinking water from an improved source for which collection time exceeds 30 minutes for a roundtrip including queuing

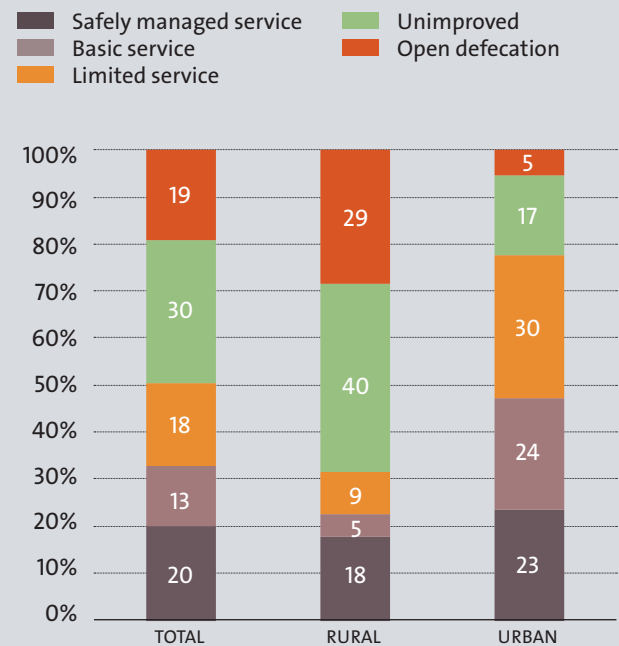
Unimproved: Drinking water from an unprotected dug well or unprotected spring

Surface Water: Drinking water directly from a river, dam, lake, pond, stream, canal or irrigation canal

Source: <https://data.unicef.org/wp-content/uploads/2017/07/JMP-2017-wash-in-the-2030-agenda-fr.pdf>

Source : WHO/UNICEF, Joint Monitoring Programme for Water Supply and Sanitation

Access to sanitation in Africa (2017)



SANITATION LADDER

Safely Managed: Use of improved facilities which are not shared with other households and where excreta are safely disposed in situ or transported and treated off-site

Basic: Use of improved facilities which are not shared with other households

Limited: Use of improved facilities shared between two or more households

Unimproved: Use of pit latrines without a slab or platform, hanging latrines or bucket latrines

Open Defecation: Disposal of human faeces in fields, forests, bushes, open bodies of water, beaches and other open spaces or with solid waste

Source: WHO/UNICEF, Joint Monitoring Programme for Water Supply and Sanitation

MAJOR PROGRESS IN ACCESS TO ENERGY, POWERED BY OFF-GRID INNOVATIONS

In recent years there has been considerable progress in Africa in terms of access to electricity. The portion of Africans with access leapt from 29% to 50% in a little under 30 years.⁶ Even so, roughly one person in two is without access to electricity⁷ and there are major disparities between regions as well as between urban and rural areas: in the latter, only a third of people have access to electricity compared to over 80% in towns and cities. The

rapid development of off-grid systems makes it possible for growing numbers of people to access alternative sources of energy. It is estimated that by 2040 less than a third of people in rural areas with access to electricity will have a connection to a national utility network.⁸

WASTE MANAGEMENT: PROGRESS NEEDED IN THE COMING YEARS

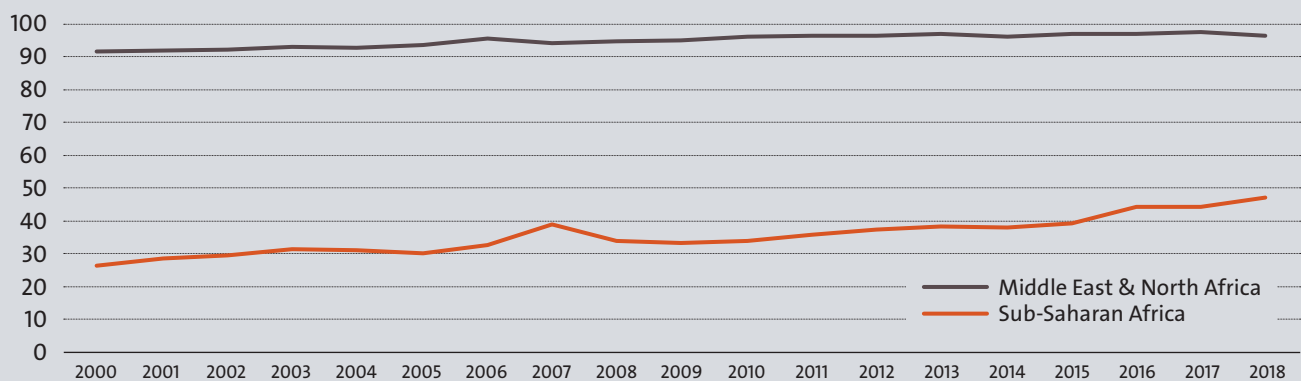
Waste collection and management systems across Africa remain highly deficient. In many countries, waste collection is primarily carried out by the informal sector, working

6 AFD, Atlas de l'Afrique, 2020

7 World Bank, 2019

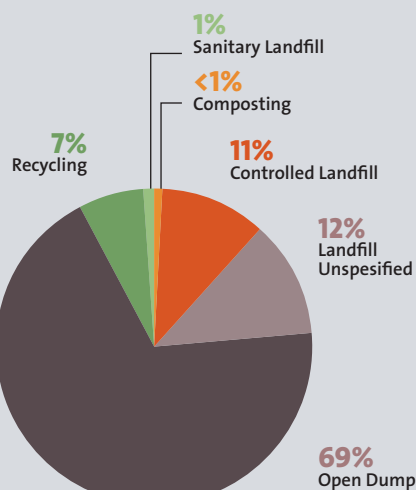
8 Africa Progress Panel, 2016

Access to electricity (% of population) in Middle East & North Africa and Sub-Saharan Africa



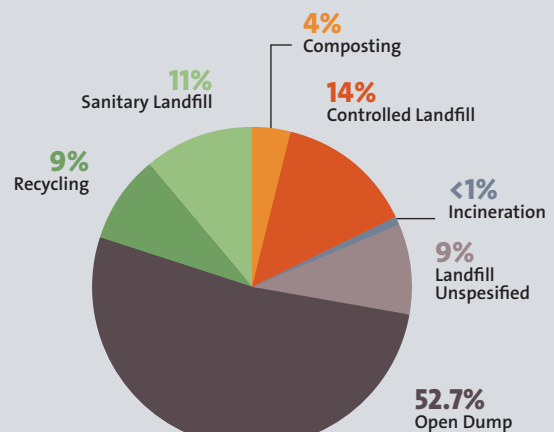
Source: World Bank, Sustainable Energy for All (SE4ALL) database

Waste Disposal and Treatment in Sub-Saharan Africa (%)



Source: World Bank, 2018

Waste Disposal and Treatment in the Middle East and North Africa (%)



Source: World Bank, 2018

outside any formalized public service provision. The importance of the task is highlighted by the fact that Sub-Saharan Africa is experiencing the world's fastest-growing increase in volumes of waste generated, and these volumes are slated to triple by 2050.⁹ Across the region, the overall waste collection rate is 43% in urban areas and just 9% in rural areas. And close to 70% of waste is dumped in open dumps. Collection rates are significantly higher in North Africa, with overall collection rates of 90% in urban areas and 74% in rural areas.

INNOVATION ECOSYSTEMS GROWING STRONGLY ACROSS THE CONTINENT

Innovation ecosystems have been growing exponentially across Africa in recent years: startups, fablabs, more or

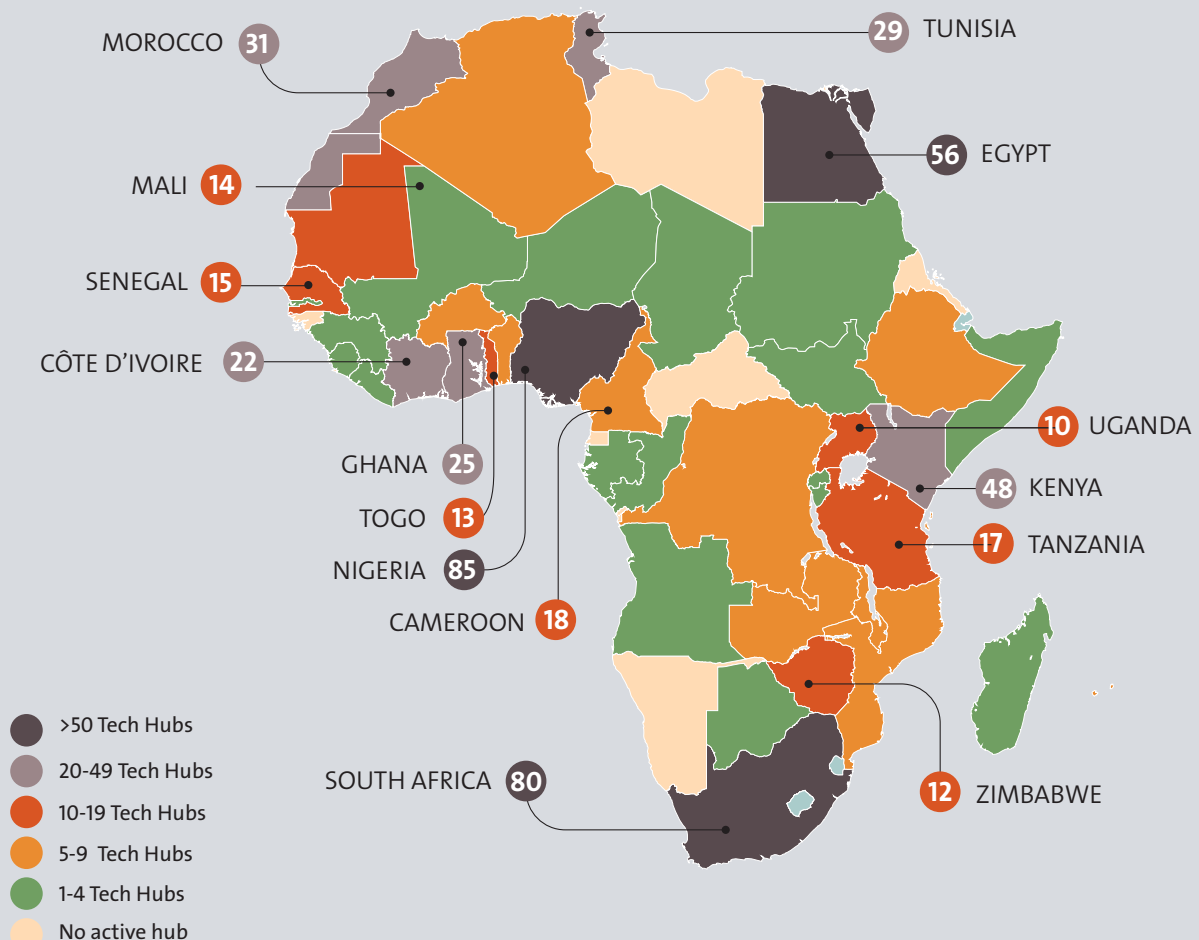
less high-tech manufacturers, and so on. The most recent estimates identified over 600 technology hubs¹⁰ (physical spaces providing support to tech startups) in Africa in 2018, mostly concentrated in Nigeria, South Africa and Kenya, as well as Morocco and Egypt in North Africa. There has also been an impressive rise in the amount of funding raised by African startups, with a 74% year-on-year increase in equity funding raised in 2018, according to the latest data from Partech Africa. And this is all in addition to myriad local structures that support community-based initiatives.

There has also been a noticeable rise in the number of alliances created to bring innovators together, either via national hubs, like Nigeria's Innovation Support Network, or as part of alliances between several regions and countries, like Afrilabs, whose current 150-plus members are drawn from 45 countries.

9 World Bank, 2018

10 GSMA, Briter Bridges, 2019

618 active technology hubs on the African continent



Source: GSMA, Briter Bridges, 2019

1. HEADING TOWARDS 2030: OUTLOOK AND CHALLENGES FOR ESSENTIAL SERVICES IN AFRICA



The demographic revolution sweeping modern Africa is primarily urban. Everybody knows that population numbers are rising and with Africa already home to close to 15% of the world's population, compared to 7% in 1960, it also has the fastest rate of population growth of any region of the world.¹ Africa's population is also the world's youngest: 60% of Africans are aged under 25, compared to 44% in emerging economies, and 80% of its people earn under \$5 a day.

This combination of phenomena – a very large and young growing population with very low incomes – has major impacts on the urbanization of Africa. The continent perfectly illustrates the ideas of American academic Edward Glaeser, who stresses the extent to which cities attract the poorest because, above all, they represent “the promise of a better life and economic and social opportunities”.

This can lead to a tendency to mistake cause for effect when worrying about the excessive numbers of poor people in a city.

Africa's cities are facing a population explosion that their very limited resources make almost impossible to control.² It is salutary to recall that the population of Lagos grew one hundredfold in less than two generations. Africapolis, the database presented in this issue by Philipp Heinrigs, uses a unique methodology to identify Africa's urban geography, based on a common definition of what qualifies as urban.

One consequence is the spread of informal settlements and services: over half the population of sub-Saharan Africa live in informal settlements, compared to 12% in North Africa.³ Aside from the financial constraints, there are many technical, economic and legal barriers hampering the development of basic infrastructure, including the absence of formalized land ownership systems. Just 17% of people in Africa have access to basic sanitation and only 37% have access to sufficient water of acceptable quality at home.⁴ Tatiana Thieme describes the “paradox of modernity” in which more people today have access to a mobile phone than access to a safe toilet option.

Managing waste is another sizeable challenge, as outlined by Martin Oteng-Ababio, with overall collection rates below 45% in sub-Saharan Africa, compared to 92% in North Africa.⁵ Where they have access to services, the poorest suffer from “poverty penalties”, often paying higher prices than the better-off – who can access public services and network connections – for services of lower quality.⁶

Obviously, Africa presents a very wide diversity of situations that have to be taken account of, and the governance of services varies from country to country. Houria Tazi Sadeq outlines the proactive attitude that authorities in Morocco take to water governance. The fact remains that in the absence of adequate publicly organized solutions, the informal sector organizes responses for meeting its basic needs that are “creative and spontaneous.”⁷ Informal and self-organized solutions spring up to improve people's access to essential services, creating unique innovative ecosystems and a vision of the smart city designed for and by Africans, as in the African Smart City described by Sénamé Koffi Agbodjinou.

There remain many obstacles to improving access to services and meeting the Sustainable Development Goals. The coronavirus pandemic we are experiencing has shattered fragile existing balances and, as stressed by Fadel Ndaw and Ibrahim Assane Mayaki, is making technical innovations and new economic and institutional models more important than ever if access to essential services in Africa is to improve.

Mathilde Martin-Moreau,
David Ménascé,
Archipel&Co,
Issue coordinators

¹ It is thought that between 2015 and 2050, half of all worldwide population growth will center on just eight countries, five of them in Africa (United Nations, *World Population Prospects*, 2016). These eight countries are India, Nigeria, Pakistan, DR Congo, Ethiopia, Tanzania, Indonesia and Uganda

² Capital cities in Africa, with populations in the millions, often have budgets roughly equivalent to a small town in a developed economy with a population of barely 10,000

³ UN Habitat, *World Cities Report*, 2016

⁴ AFD, *Atlas de Africa*, 2020

⁵ World Bank, 2018

⁶ For more on this, refer to the works of C.K. Prahalad

⁷ Hernando de Soto, *The Mystery of Capital*, 2000

BRAKES AND LEVERS FOR THE DEVELOPMENT OF ESSENTIAL SERVICES IN AFRICA

Dr. Ibrahim Assane Mayaki
Chief Executive Officer, African Union Development Agency

THIS INTERVIEW WAS CONDUCTED PRIOR
TO THE COVID-19 CRISIS IN AFRICA



Ibrahim Assane Mayaki has been Chief Executive Officer of the African Union's New Partnership for Africa's Development (NEPAD) since 2009. In 2018, NEPAD was renamed the African Union Development Agency (AUDA-NEPAD). Dr. Mayaki was prime minister of Niger from 1997 to 2000, and is founder of the Public Policy Analysis Circle, a thinktank focused on health and education policy. He has taught public administration and management in France, Niger and Venezuela. His most recent book, *Africa's Critical Choices: A Call for a Pan-African Roadmap*, calls for pan-African solutions for the continent's development and exhorts younger generations to meet these challenges.

There are a range of factors that explain why Africa is lagging behind in terms of access to essential services: limited institutional capacities of African states and extreme centralization of decision-making processes, sparsity of institutional and technological support for innovation, and absence of legislation designating these services as common goods. Added to this are difficulties in financing such services, at a time when a number of countries are cutting their development aid budgets. But, bolstered by its resilience and innovation capacity, the continent boasts formidable resources that allow it to innovate and build new ways of access to services for the future, especially through supporting the capacity of citizens and SMEs for bottom-up innovation and through improvements to previously weak fiscal systems. These priorities are clear in the AUDA-NEPAD vision, which promotes multisectoral approaches, supports technological innovations and leverages impact assessments to convince other actors to commit to projects that are all-embracing and innovative.

Access to essential services is a precondition for human development. What are the specifics of the situation on the African continent in terms of developing these services and making them available as widely as possible?

Ibrahim Assane Mayaki: It is absolutely unarguable that developing access to services like energy and water is an essential condition for human development. Access to essential services must always be approached in ways that are holistic and multisectoral and this is the vision promoted by AUDA-NEPAD. There is far more to development than simply adding up a given number of essential services because the interactions between them are so numerous, raising questions that touch on institutions and governance. Energy, for example, is a non-negotiable] for accessing all other services, be these education, health agricultural production.

There is more to development than simply adding up a given number of services; it is a far more complex question of governance and multisectoral approaches

Access is also a real challenge to the continent when you consider the trends we've seen in Africa over the past two decades. I want to raise these points here as they are fundamental to understanding the context. Firstly, our continent has yet to complete its demographic transition; according to UN statistics, Africa's population will double by 2050, rising from 1.3 billion in 2020 to 2.5 billion in 2050. And Africans will be increasingly urban, with 60% of them living in cities in 2050, according to the UN. They will of course need energy to power city services and underpin economic growth.

From the start of the 21st century until very recently, Africa witnessed relatively sustained economic growth,

a fact noted and praised by all the leading international organizations. According to the World Bank, GDP growth in Sub-Saharan Africa averaged 5% annually from 2000 to 2014, then 2.2% from 2015 to 2018. This is clearly positive, for without growth it is impossible to develop access to services. But, sadly, this has not been accompanied by sufficient economic diversification to create enough jobs on the continent.

Also, given Africa's demographic growth, the number of Africans living in extreme poverty has not actually fallen by volume. In relative terms, the extreme poverty rate in Sub-Saharan Africa has fallen from 58% in 1999 to 41% in 2015, according to the World Bank. But in absolute terms, the number of people living in extreme poverty rose from 381 million in 1999 to 416 million in 2015. Some progress has been made, but if this trend continues there is a risk that we will soon be home to almost all the extreme poverty in the world. If nothing changes, forecasts show that Sub-Saharan Africa will be home to almost 90% of all humans living in extreme poverty in 2050.

Population growth, concentration of extreme poverty and rampant urban growth [...] Africa will face two fundamental crises within the next 20 to 30 years: a crisis of agricultural production, because its ever-growing population must be fed, and an energy crisis, because its ever more urban population will need a sufficient energy supply. It will have to provide its mostly urban population with quality services in a context where extreme poverty will continue to be present. This will likely have a real impact on the stability of governance systems and institutions. This clearly shows why development is far more than simply adding up possibilities of access to services – it is a far more complex question of governance and multisectoral approaches.



What are the main brakes to the development of access to services in Africa?

IAM: I feel that the institutional question is extremely important. Sadly, African states do not have the capacity to deliver quality services fairly and efficiently to their populations, be it water, energy or health care.

The first brake centers on how public policies are determined and the appropriate scale for putting them into action. Finance is clearly also an essential question, but above all it is the way that public policies are determined that requires radical change. Decision-making has to be decentralized. Actors at the local level have the most accurate vision of needs and the appropriate mechanisms to deploy when delivering services. The role played by the central government should be limited to ensuring resources are allocated appropriately, then leaving local authorities responsible for management. The method used to define and manage a service has a direct incidence on the quality of the service delivered. The local level has a key role to play here.

Secondly, the rate of institutional innovation and co-production of public policies with stakeholders needs to be accelerated. Digital technologies can help here. Through their use of cellphones, the people of Africa have never been better connected. The percentage of smartphones in use is on track to rise from 39% in 2018 to 66% in 2025, according to the GSM Operators Association. Failure to embrace this phenomenon when adapting how services are accessed would be a massive error. We're already seeing new uses for these technologies to help with access: mobile payment systems with prepaid water meters, drones to ship spare parts for irrigation systems to remote areas, and so on. It's worth noting that these innovations have generally been rolled out without state help, in a process that is self-fueling and bottom-up. This is yet another argument in favor of decentralized decision-making as a way to deliver better access to services.

Lastly, we need to look again at how states legislate in terms of access to services. Water and energy, for example, are public goods that absolutely must be protected by legislative reforms that ring-fence their universal character: water must be defined as a human right, not a convenience provided by the state. These profound reforms are needed to guarantee access to resources for all and to protect the most vulnerable groups.

This means states must reinforce their institutional capacities. Investments in the supply of services by international bodies and development agencies regularly end in failure on rollout because they fail to account for institutional problems.

In terms of financing these services, you often talk of an end to the development aid model in the coming years. What will be the implications for essential services?

IAM: In terms of development aid, the OECD and the UN both highlight two realities: developed countries do not always deliver what they promise, and there is a structural decrease in public development aid.

Development aid has had very positive impacts in heading off serious crises, and I'm thinking particularly of the Ebola epidemic. But it also has unwelcome consequences. Some of these relate to bureaucratic practices that can breach ethical norms, others to the fact that it stifles innovation. Development aid will diminish and no doubt disappear, which raises the following question: what are the learnings and priorities that will enable the continent to finance its own development in future?

The first, critically and urgently, is that Africa's states must boost their national income through raising tax revenues. Africa is the continent with the world's lowest tax take. The idea here is not to levy money from the poorest households, but to make sure that those who can are obliged to genuinely participate. The continent also needs to tackle illicit financial outflows: tax evasion, money laundering, corruption, etc. Africa loses tens of billions of euros illicitly every year – money that could be invested in our development.

The end of development aid will help us to become more inventive and innovative, and to embark on far-reaching fiscal reforms. It also opens the door to new, more horizontal partnerships, in particular with Europe. I share the view that Africa is Europe's

future. I believe in partnerships that are constructive for both continents, based on relationships between small- and medium-size businesses from Europe and Africa, and the transfer of environmentally friendly technologies. It is relationships of this type that will enable Africa to grow in influence over the years ahead.

Decision-making has to be decentralized: it is the local level that has the most accurate vision of needs and the appropriate mechanisms to deploy when delivering services

What gives you the most hope for the development of essential services over the coming decade?

IAM: Africans are outstanding innovators. And as states come up against their own institutional limitations, as I mentioned above, it is the people of Africa who are innovating. Small businesses and startup networks are organizing to fast-track solutions that reflect local realities and local needs. Actors such as these often work in ways that are far more democratic than central administrations. They reach out to and involve local people, one of the keys to creating sustainable solutions for access to services. This is what state reform needs to look like: from the bottom up, giving power to innovative local actors so that they can realize their full potential.

Financing is another essential lever if they are to be given what they need to succeed. This is one of the biggest hurdles facing the continent's innovation ecosystem: the ideas are there but there's no financing. States could support this ecosystem by, for example, offering a system of guarantees to innovative startups.

The end of development aid will help us to become more inventive and innovative, and to embark on far-reaching fiscal reforms

AUDA-NEPAD aims to facilitate and coordinate implementation of priority regional and pan-African continental projects. What are its areas of focus and actions in terms of access to essential services?

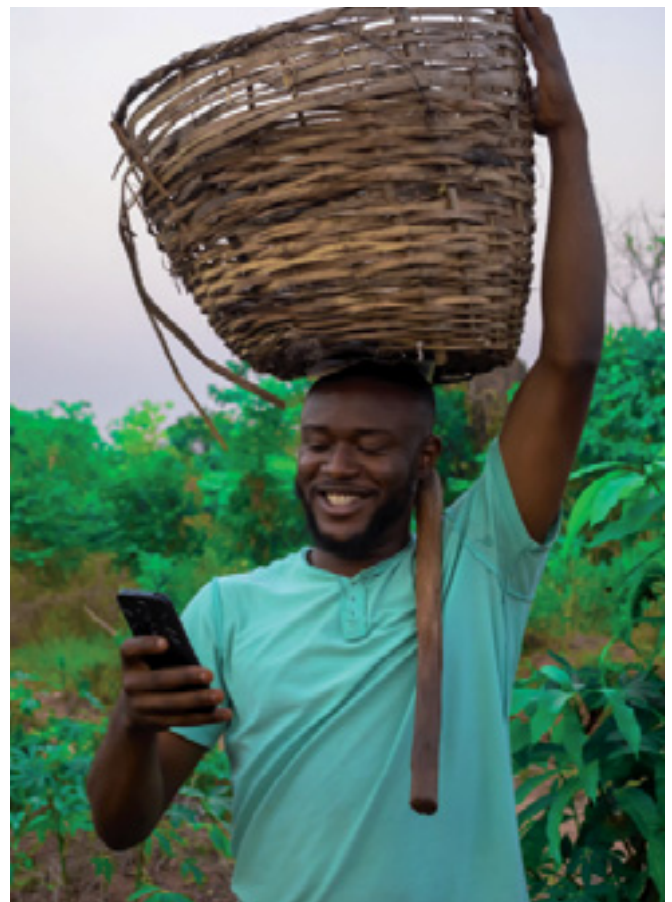
IAM: AUDA-NEPAD places enormous importance on multisectoral approaches. We are absolutely convinced that problems surrounding access to services, and by extension development, across the continent must be addressed with approaches that are holistic and coordinated. For example, we are currently working in a village in Niger, and across several other countries in West Africa, to design a program that combines solutions for supplying renewable energy with access to irrigation and health care. It is a very good illustration of the AUDA-NEPAD approach – all separate problems tackled together as a whole.

We also steadfastly believe that technological innovations can create solutions to the continent's problems. AUDA-NEPAD is the regional institution with the greatest focus on new technologies: artificial intelligence, drones, genetic adaptations to boost farming yields, and so on. This is another area of focus where the agency devotes much of its efforts.

There are a number of initiatives that structure AUDA-NEPAD's work to promote access to services. The Program for Infrastructure Development in Africa (PIDA) was launched by the African Union Commission (AUC), AUDA-NEPAD and the African Development Bank (ADB) to improve infrastructure for energy, water, transport and ICT and, in so doing, to promote regional integration. We have chosen 51 priority projects, always looking for holistic approaches. For example, this initiative has so far made possible 3,500 kilometers of power lines. Another initiative, Sustainable Energy for All (SE4ALL), was launched in 2011 by the AUC, AUDA-NEPAD and the ADB in partnership with UNDP, the United Nations Development Program. It aims to achieve three main goals by 2030: provide universal access to modern energy services; improve energy efficiency; and double the share of renewable energy in the combined regional energy mix.

Our goal is to deploy, test and evaluate systems locally, then leverage the best approaches so that they are taken up and used in other regions and countries.

This also means that impact assessments are a third key pillar to our work. We design and deploy advanced assessment systems to help us identify the best possible configurations, but also to help us persuade other actors to copy our solutions.



HOW CAN AFRICA'S WATER COMPANIES BOOST THEIR RESILIENCE WHEN FACING HEALTH CRISES?

Fadel Ndaw

Senior Water and Sanitation Specialist, World Bank



Fadel Ndaw has over 30 years' experience in water and sanitation. He holds an engineering degree from the National School for Water and Environmental Engineering in Strasbourg, France. In April 2019 he was appointed senior water and sanitation specialist at the World Bank office in Côte d'Ivoire. From 2012 to 2018 he worked for the World Bank in Burkina Faso and Egypt. In 2011 and 2012, before joining the World Bank, Mr. Ndaw worked for the African Water Association of Utilities as coordinator of the Water Operators Partnership Africa (WOP-Africa), a program based in the offices of Rand Water in Johannesburg.

During the 15 years from 1996 to 2011, Fadel Ndaw played a major role in Senegal, helping to implement reforms to the urban water and sanitation sector and acting as coordinator of the water sector project (PSE), the long-term water project (PLT) and the Millennium Development Goals program (PEPAM).

The current global pandemic has again highlighted the importance of access to reliable water sources as part of on-going efforts to combat the virus and prepare for future pandemics. On the African continent, 70% to 80% of illnesses can be linked to poor water quality and inadequate sanitation systems. Water companies have grappled with multiple constraints in the face of the emergency created by the COVID-19 pandemic. They have been forced to adapt in order to continue operating and supplying people with drinking water. This article seeks to analyze the main problems encountered by water companies in Africa during the crisis, and suggests paths for further reflection that will help them become more resilient so that they are ready to face new pandemics in the future.

INTRODUCTION

The COVID-19 pandemic has placed massive strains on Africa's water utilities. Water companies have had to deal with falling incomes, higher costs, notably for inputs such as chemicals and spare parts, and the need to maintain quality of service while also setting up emergency systems for providing clean water to the most vulnerable groups and members of society. Hand-washing is universally recognized as one of the most important basic measures for attenuating the risk of coronavirus contamination, but it is equally true that providing a constant supply of safe water to everybody during the emergency phase of this crisis has proved to be a massive challenge.

WATER COMPANIES IN AFRICA HAVE ROLLED OUT EFFICIENT STRATEGIES TO HELP DEAL WITH THE CRISIS

Many towns and cities across Africa have had to enact emergency measures to limit contamination and risk of infection. Close to 60% of the population of sub-Saharan Africa lives in shanty towns and informal settlements, where the risk of community transmission is very high. The lack of basic services and infrastructure, particularly for health and hygiene, and widespread reliance on collective installations such as standpipes and public latrines, where it is difficult to maintain social distancing, have helped to drive accelerating rates of infection and made it harder to contain the spread of the virus.

The municipality of eThekweni on South Africa's east coast has a population of 3.8 million, with 27% of its residents living in informal districts. The municipality supplies 520,000 rural and urban customers with water and sanitation services. During the crisis, the water company faced difficulties in supplying informal districts with particularly high population densities. Frequent interruptions to water supplies were noted as a result of illegal connections caused by high levels of poverty and unemployment. The decision was taken to pause work to cut off illegal connections and switch the

focus to supplying no-cost services and repairing leaks. Dedicated rapid-reaction teams were set up to respond to demands. The water company was able to guarantee that water was available to all residents thanks to (i) continuity of supply through the use of tanker trucks and storage tanks in areas without water supply, and (ii) identification of clusters, which were given emergency water supplies.

SOCIAL MEASURES ORDERED BY GOVERNMENTS HAVE NEGATIVELY IMPACTED THE CASH POSITION OF WATER COMPANIES

In Senegal, the government decided to help households pay their water bills for March and April 2020, providing a total of 3 billion CFA francs (\$5 million) to approximately 670,000 consumers. In several countries, governments also ordered the suspension of water bills for all or part of the population. However, costs arising from such a suspension and the accumulation of unpaid water bills can have lasting repercussions on water companies' financial viability.

In the short term, there is a high risk of interruptions to continuity of service as a result of a failure to cover operational costs such as water treatment chemicals and spare parts.

During the crisis, water companies have had to deal with falling incomes, higher costs, notably for inputs such as chemicals and spare parts, and the need to maintain quality of service



In Uganda, the National Water and Sewerage Company (NWSC) saw a significant fall in the rate of water bill payments by its users, down from 98% in January 2020 to 61% in March 2020. This was a consequence of government measures banning the disconnection of water supplies in the event of nonpayment of the water bill. To tackle this situation, NWSC took the following steps to mitigate the impact of these policy measures:

- the government committed to: i) settle its outstanding debts; ii) provide subsidies for operating costs.
- commercial loans for priority needs, for example chemicals and reagents, and payment of outstanding debts to chemicals suppliers to ensure continuity of supplies.

A suspension of billing may have long-term repercussions on many people's willingness to pay, and the political sensitivity of the issue may further complicate future debt recovery efforts.

AFTER THE CRISIS, WATER COMPANIES WILL NEED TO RAMP UP THEIR RESILIENCE

In order to successfully navigate this bill repayment and construction phase, as well as to guard against future pandemics, it is vital that Africa's water utilities establish resilience policies to protect the supply of water, sanitation and hygiene services to all the people they serve. Several options are available to them.

ESTABLISH MEASURES TO ACCELERATE ACCESS TO WATER FOR THE LEAST WELL-OFF

Africa needs to invest massively in its water and sanitation sectors over the coming decade if it is to meet the sixth Sustainable Development Goal. However, the countries of Africa commit a maximum 0.5% of their GDP to this sector, and only allocate a tiny portion of international aid to it. This vital problem of access to drinking water becomes all the more acute in the light of the continent's fast-growing

urbanization. By 2050, three-quarters of Africa's 2.2 billion people will be living in cities and shanty towns. Vast megacities such as Lagos (23 million inhabitants) or Kinshasa (12 million inhabitants) as well as around a hundred other cities with a million or more residents, will see their populations double in the coming years. This means that water companies need to plan ahead, working in close collaboration with city planners

to harmonize interventions, particularly with a view to restructuring spontaneous and low-income districts. The challenge is to find innovative solutions for supplying drinking water and managing water services — including recourse to community-based local private operators, as occurs in Ouagadougou, Burkina Faso — in areas with high population densities where, with most residents working in the informal sector, their unpredictable incomes prevent them from paying a water bill every two or three months.

In Senegal, the government decided to help households pay their water bills, providing a total of \$5 million





GUARANTEE THE LONG-TERM FINANCIAL VIABILITY OF WATER UTILITIES

A recent World Bank study of the performance of water companies in Africa showed that half the continent's water utilities do not have sufficient income to cover their operating and maintenance costs. This points to the need to strengthen the operational capacities and resilience of public and private water companies so that they are able to provide water of good quality, in sufficient quantity and at a price that is politically and socially acceptable, all while remaining financially viable. Making state aid conditional on meeting performance targets that are tangible, transparent, verifiable and within the service supplier's control can help to avoid inefficiencies associated with traditional forms of subsidy. Key performance indicators, established by governments or regulators, can include standards for continuity of service, decreases in the volume of non-billed water use, renewal of pipe networks and meters, or handling of consumer complaints.

Water companies can also improve their post-COVID-19 reconstruction by identifying benefits from the circular economy in terms of wastewater and stormwater reuse and recourse to public-private partnership models as ways to boost efficiency.

Prompt payment of outstanding sums owed by governments can be an efficient and rapid-impact way to ensure continuity of service. In the Democratic Republic of the Congo, nonpayment of amounts owed to water company REGIDESO are a longstanding problem, totaling \$176 million as of March 2020. A partial payment of the outstanding amount, approximately \$30 million, was scheduled to enable the company to cover its losses during the three-month crisis.

ADOPT NEW TECHNOLOGIES TO BOOST WATER SECURITY

What is the best way to use new technologies to ensure efficient interventions during a health crisis and for debt management and recovery? It is important to remember

that water companies in Africa are often hamstrung by a lack of these types of technologies and data. Most water companies do not have sufficiently robust basic data on topics such as the volume consumed by any one household, usage habits, physical and commercial water losses, and identification of the poorest households and districts with the patchiest service. Data governance is often inadequate, meaning that up-to-date data are unavailable for measuring impacts during crises such as the COVID-19 pandemic. Any analysis not based on credible up-to-date data can misdirect any current or future response. Use of geospatial mapping to identify at-risk zones and people impacted can also help to set up effective emergency actions. It is clear that countries like Singapore and South Korea, with efficient spatial data infrastructure, have seen better results in terms of fighting infection.

Switching to the use of smart meters and updated electronic registers of poor and vulnerable people would also allow these customers to pay their water bills via cellphone at shorter intervals, reflecting their irregular incomes.

CONCLUSION

The COVID-19 crisis has placed additional strain on a sector whose work is critical to responding to the pandemic, while simultaneously shrinking one of its main sources of finance. Lessons learned from past economic crises show that water infrastructure received lower funding as a consequence of lower levels of public investment. With little political will to devote a portion of budgets earmarked for kick-starting national economies to the water sector, and in the absence of any adaptation by water companies to the new context in terms of setting up innovative strategies for responding to the current health crisis and preparing for those around the corner, there is a risk of amplifying existing deficiencies in terms of access to safely managed water services, thereby compromising the long-term viability of the entire sector.

AFRICAPOLIS: UNDERSTANDING THE DYNAMICS OF URBANIZATION IN AFRICA

Philipp Heinrigs

Senior Economist with the Sahel and West Africa Club Secretariat (SWAC)
at the Organization for Economic Co-operation and Development (OECD)



Urban Africa: numerous agglomerations with over 10,000 inhabitants, 2015. OECD/SWAC (2020), *Africa's Urbanisation Dynamics 2020: Africapolis, Mapping a New Urban Geography*, West African Studies, OECD Publishing, Paris, <https://doi.org/10.1787/b6bccb81-en>

Philipp Heinrigs is a Senior Economist with the Sahel and West Africa Club Secretariat (SWAC) at the Organization for Economic Co-operation and Development. The purpose of SWAC is to promote regional policies to improve living standards in West Africa. An OECD economist for over 16 years, Philipp Heinrigs is an expert on African economics and urbanization. He co-directs the Africapolis program and co-authored *Africa's Urbanisation Dynamics 2020: Africapolis, mapping a new urban geography*, published by SWAC/OECD.

Africa is undergoing unprecedented urbanization. But the dynamics driving this trend are poorly understood for several reasons, including the lack of a common definition of urban, unreliable demographic data, and over-representation of major agglomerations. Africapolis is a database that offers a common definition of urban and an innovative methodology based on cross-referencing satellite images with demographic data. It shows that Africa is far more urban than it appears, with the continent home to hundreds of agglomerations that are not officially recognized. Africapolis also shines a light on the diversity of ways that urbanization manifests itself: the appearance of spontaneous metropolitan regions and mega-agglomerations, the central role of rural transformations in urban growth, the emergence of intermediary agglomerations, and inland urbanization that creates a new balance in terms of the importance accorded to coastal cities. Lack of official recognition for numerous agglomerations is the source of major imbalances in terms of visibility, resources and capacities allocated by central governments. The work conducted by Africapolis helps policymakers better understand the realities of their territory and harness the potential of the continent's urban dynamics.

INTRODUCTION

Between 1950 and 2015, Africa's urban population rose from 27 million to 567 million people, a 2,000% increase. Currently, half of all people in Africa live in an agglomeration with a population greater than 10,000. Africa's urbanization dynamics are particularly difficult to understand for reasons that include varying definitions of urban and a lack of reliable up-to-date demographic data.

Africapolis, a database produced by the Sahel and West Africa Club¹ (SWAC), offers a common definition of urban and an innovative methodology based on cross-referencing satellite images with demographic data. The figures and analyses presented in this article are drawn from *Africa's Urbanisation Dynamics 2020: Africapolis, mapping a new urban geography*.² This work provides an objective assessment of the continent's urban dynamics. First, Africa is far more urban than it appears, with the continent home to hundreds of agglomerations that are not officially recognized. Next, rural transformations play a key role in driving African urbanization. Also, the continent is home to new urban forms such as metropolitan regions and spontaneous mega-agglomerations. Last, an inland urban Africa is emerging, counterbalancing the dominant view of

¹ For more information: <https://africapolis.org/home> and www.oecd.org/swac

² OECD/SWAC (2020), *Africa's Urbanisation Dynamics 2020: Africapolis, Mapping a New Urban Geography*, West African Studies, OECD Publishing, Paris 2020 <https://doi.org/10.1787/b6bccb81-en>.

coastal urban Africa. This ground-breaking analysis calls for a policy-making response, which is essential to improving the allocation of resources and to the informed planning of access to services across territories and long-term guidance for urban development.

AFRICA'S URBAN DIVERSITY

Africa is undergoing an unprecedented urbanization phenomenon: since 2010, the urban population of Africa has grown by 21 million every year. In 2015, for example, Kenya had more urban dwellers than the whole of Africa in 1950.

Since the 1990s, strong demographic growth has been the primary driver of this urbanization: Africa's population has more than doubled since 1990 to reach 1.2 billion people in 2015, and is set to double again by 2050.³ Urbanization dynamics are influenced by many other factors whose impacts vary depending on the national context: climate and geography, people's income, public institutions and policies, economic cycles, conflicts, etc.

There are several difficulties that make it harder to build a global, comprehensive understanding of Africa's urbanization dynamics. First of all, there is no common definition in Africa, as in the rest of the World, of an urban area, and at times demographic data are unreliable and/or rarely updated. International statistics also tend to over-represent major agglomerations, and the impossibility of separating official areas from spontaneous areas in agglomerations illustrates the need for a spatial approach.

DISPARATE DATA AND DEFINITIONS ACROSS THE CONTINENT

The different definitions of urban can be grouped into three categories: cities, agglomerations and metropolitan regions, corresponding to three distinct approaches.

- The city is defined as a politico-administrative entity: its legal status and boundaries are determined by the state on the basis of various administrative criteria. The first limitation with this approach is that the boundaries of the city are not always visible; boundaries can be drawn across continuously built-up areas, creating an invisible separation between city and suburb. Criteria defining a city may also restrict the acceptance of change, and fail to represent changing territorial urbanization. In Egypt, only administrative capitals are defined as cities, and their number has barely changed since 1960. The country's official level of urbanization has therefore remained stagnant at around 43% for a half century.
- An agglomeration is defined using a spatial approach based on land use. This is an area defined as a set of dense constructions: density can be measured either by number of inhabitants per unit of surface, or as a maximum



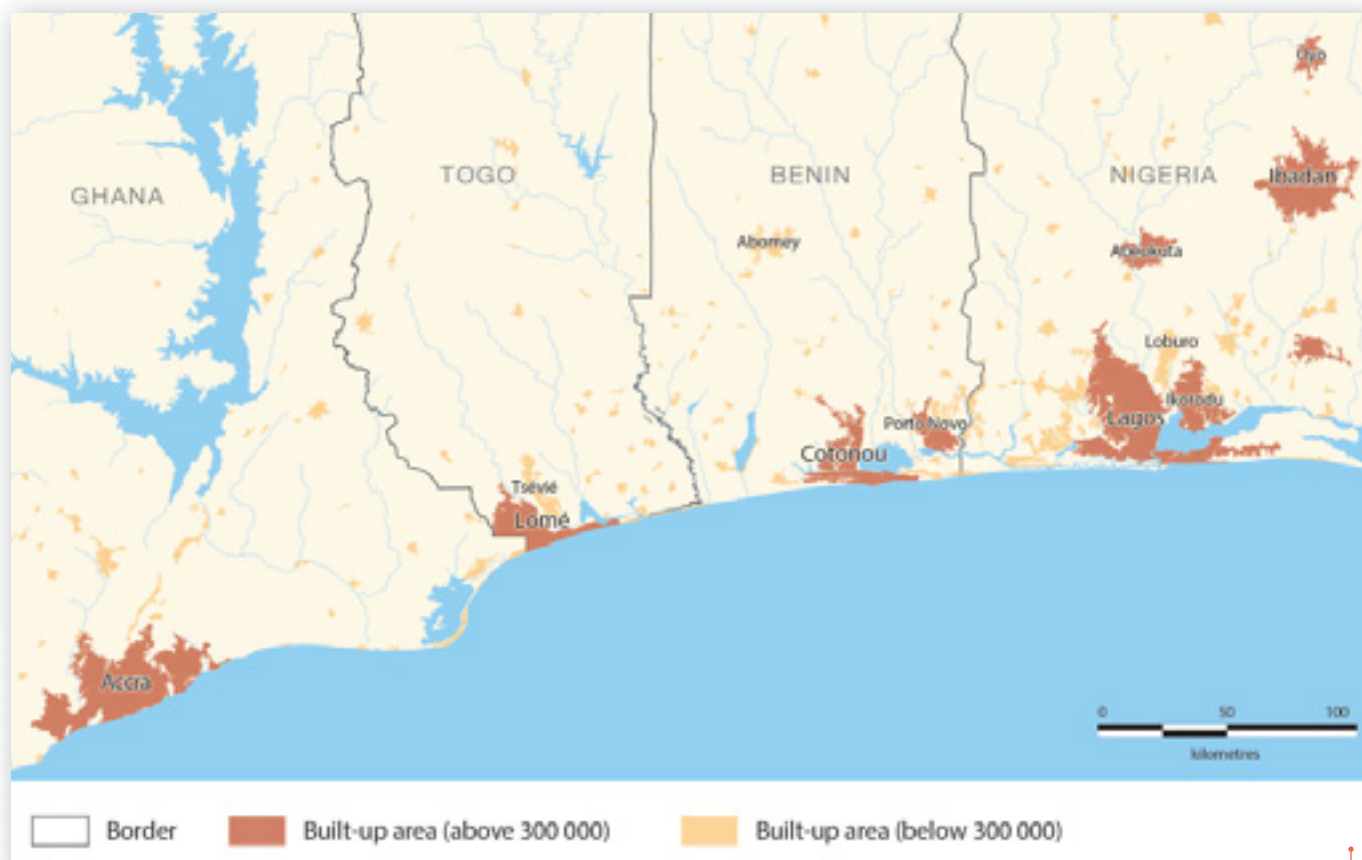
Matola and Maputo (Mozambique): two municipalities, one agglomeration. SWAC/OECD (2020)

distance between buildings. Urban agglomerations conform to several criteria: minimum population, percentage of non-agricultural households, presence of certain infrastructure and administrative functions, etc. If one or several of these criteria are fulfilled, the area is considered an agglomeration, which may contain several cities in the administrative sense of the term. This approach is used by several African countries, but each with their own criteria and thresholds. The difference between a city and an agglomeration is exemplified by Maputo, the capital of Mozambique, which is a separate municipality from neighboring Matola. However, spatially they are part of the same agglomeration.

- The metropolitan region is a functional approach. It is defined as a set of more or less dense flows and networks of people, goods and services. It aims to show that the sphere of influence of large cities does not end at the agglomeration's boundaries but extends to functionally connected satellite locations. Although extensively used around the world, South Africa is the only country in Africa to recognize this category.

Every state in the world defines the city according to its own criteria. The absence of a recognized shared definition makes it hard to compare data and to generalize results on the regional or continental levels.

³ United Nations, Department of Economic and Social Affairs, Population Division (2019). World Population Prospects 2019, custom data collected from the website.



The Greater Ibadan Lagos Accra Urban Corridor: a transnational metropolitan region. SWAC/OECD (2020)

National definitions are not always reliable because they can fluctuate over time and tend to reflect political strategies, with statistical frameworks directly related to electoral maps, taxation, land rights, etc. Administrative boundaries are therefore sometimes arbitrary: the administration can statistically create, modify or erase a city to hide certain imbalances. In Nigeria, there is no statistical definition of the urban population because city boundaries are divided into local government areas that make estimating the population impossible, and the 2011 census was cancelled.

Data from some countries can be out of date owing to a lack of administrative capacity. The most extreme cases are the Democratic Republic of the Congo (last census in 1984) and Somalia (last census in 1975).

OVER-REPRESENTATION OF LARGE AGGLOMERATIONS IN INTERNATIONAL STATISTICS

The United Nations World Urbanization Prospects⁴, the main reference for

urban statistics at the international level, only contains agglomerations with over 300,000 inhabitants in Africa and lists 210 of them: they account for just 3% of the agglomerations identified by Africapolis. This discrepancy illustrates the high level of under-representation and limited knowledge of small and intermediate agglomerations.

ACCOUNTING FOR OFFICIAL AND SPONTANEOUS ZONES IN AGGLOMERATIONS

Irrespective of the need for homogenization, a spatial approach to urbanization is equally important in order to properly comprehend the dynamics at play. The spatial approach is justified by a number of observations, primarily the impossibility of separating the official and the spontaneous areas in agglomerations. Thousands of agglomerations have a “planned” or “official” area and one or more “spontaneous” areas.

Urbanization is developing outside statistical definitions. A spatial and homogenized definition of what is meant by “urban” is needed to implement development policies that match realities on the ground

Urbanization develops outside statistical definitions. This is why Africapolis favors a homogenized definition and spatial approach to measuring urban phenomena. This approach

⁴ United Nations, Department of Economic and Social Affairs, Population Division (2019), World Urbanization Prospects, The 2018 Revision.

makes it possible to identify key features of African urbanization, such as urban sprawl, *in situ* urbanization of rural areas, and the emergence of metropolitan regions. It also makes it possible to compare phenomena on a continental scale and over time, and thereby to implement development policies that match realities on the ground.

THE AFRICAPOLIS METHODOLOGY: A SPATIAL AND BOTTOM-UP APPROACH

INNOVATIVE METHODOLOGY

The Africapolis database was created to provide a unified method and definition of urban in Africa, and to describe trends in urbanization. It was designed to enable long-term comparative analysis of urbanization dynamics in Africa.

Africapolis uses a spatial approach to measure urbanized space. The approach focuses on concrete spatial manifestations of urbanization — it could also be described as morphological — to make comparisons across countries and time possible. The database applies the same definition of urbanized space to all countries, regardless of nationally specific definitions. Africapolis defines an agglomeration as urban if its population exceeds 10,000 and a continuously built environment with less than 200 meters between buildings. This approach, also used by countries such as France and Sweden, allows for the inclusion of a major characteristic of urbanization that is ignored with an administrative approach: urban sprawl. The advantage of the spatial approach is that it does away with the limitations imposed by administrative definitions of urban realities, limitations that are all the more evident in the African context where it is impossible to separate official urban areas, which are planned, from areas that are spontaneous or informal.

Africapolis draws its data from two sources: population data available nationally and/or locally, and satellite images collected from Google Earth. The methodology is built on a new generation of technologies — satellite images and a geographical information system database — and uses the largest collection of localized census data ever compiled in Africa. This is also very much a bottom-up approach because Google Earth allows anybody to check the accuracy of data by reposting them on the platform, and to consult the census documents, which are public sources.

The protocol used by the Africapolis teams is as follows: first, demographic data are collected from available statistical sources before being harmonized and disaggregated into local units, shown as points. Then, satellite images are analyzed to provide remote detection of built-up areas and polygons are used to delimit urbanized zones. Last, the most painstaking phase involves linking the data by cross-referencing the local units (geo-referencing of points) with the urbanized zones (polygons) in order to identify all agglomerations with over 10,000 inhabitants.

COMPLEMENTING NATIONAL STATISTICS

Results generated by Africapolis complement national data and provide a different view of urbanization: agglomerations identified by Africapolis but not officially recognized coexist with official cities that Africapolis does not consider urban. Even within agglomerations of more than 10,000 inhabitants, some sections may be officially recognized as rural and others as urban.

The database shines a light on several key issues: Africapolis reveals the existence of a great many agglomerations that are not recorded in official statistics. This concerns agglomerations of all sizes, some in excess of a million residents, such as Sodo and Hawassa in Ethiopia. Lack of recognition of these agglomerations has a major policy impact in terms of planning and the allocation of resources. Africapolis data indicate that the levels of urbanization observed are higher than officially reported in 25 of the 50 countries covered.

African urbanization cannot be understood simply by studying a sample of large cities, nor is it simply a matter of urban versus rural. Through the use of spatial satellite data, Africapolis reveals and highlights the diversity of urbanization forms.

KEY LESSONS: URBAN DYNAMICS AND THE NEW GEOGRAPHY OF AFRICA

AFRICA IS ALREADY WIDELY BUILT-UP

The continent is already far more urban and its agglomerations far more numerous than the international statistics tell us. As previously mentioned, World Urbanization Prospects⁵ only takes account of cities with over 300,000 inhabitants, producing an inventory of 210 agglomerations for the entire African continent. But this is just 3% of the agglomerations identified by Africapolis, which has identified 7,617 of them. Like most other continents, Africa comprises a majority of small- and medium-sized towns: in 2015, there were 25 agglomerations of over 3 million residents, and 5,000 with fewer than 30,000.

THE RISE OF THE METROPOLITAN REGION

Where urbanization is concentrated in certain zones, new forms of settlement develop, such as metropolitan regions. The same region might see the emergence of major agglomerations as well as small- and medium-sized agglomerations. This dynamic leads to new forms of concentration, with lower density but strong economic and social integration. They can be transnational: West Africa has an urban corridor linking Ibadan to Accra via Lagos, Lomé and Cotonou, known as The Greater Ibadan Lagos Accra Urban Corridor. The metropolitan regions

⁵ United Nations, Department of Economic and Social Affairs, Population Division. (2019), World Urbanization Prospects, The 2018 Revision.

surrounding these agglomerations juxtapose to form a transnational metropolitan region: exchanges between metropolises become more intensive than exchanges with intermediate cities, accelerating disparities with the rest of the country where development remains difficult.

THE EMERGENCE OF SPONTANEOUS MEGA-AGGLOMERATIONS

The work also points to another form of urbanization: spontaneous mega-agglomerations that constitute the intersection between several secondary urban regions. Fifteen agglomerations of this type were identified, representing 8% of the urban population (35.7 million people), underlining the importance of taking the spatial criterion into account. Within these vast morphological units, only a few urban centers, if any, are officially recognized. In light of demographic growth and decreasing rural exodus, it is highly likely that this process will intensify, which is why it is so important to inform the policy-making process of the current transformations and the impacts they will have.

THE EMERGENCE OF INTERMEDIARY CITIES

Today, 210 million Africans live in one of the continent's 1,400 intermediary cities. These cities play an essential role in structuring the urban network and connecting the local and regional levels with the continental and global levels, a phenomenon very little studied previously.

RURAL TRANSFORMATIONS

Aside from demographic growth, two major factors in urbanization that relate to rural transformations can be observed. First is the urban sprawl that swallows up existing rural settlements. Unlike a city's administrative limits, the morphological limits of an agglomeration fluctuate over time: this is the phenomenon of urban sprawl, traditionally defined as the expansion of an urban built environment to undeveloped agricultural or natural spaces. But this definition is overly restrictive because in reality agglomerations also swallow previously inhabited rural areas. So, as well as sprawling they also absorb existing rural settlements. One example is in Egypt, where Cairo has absorbed countless rural towns and villages.

But the most surprising and massively widespread phenomenon is the *in situ* urbanization of rural areas. This is a phenomenon that occurs once a rural zone reaches a density that means it is reclassified as urban. The increasing density goes hand in hand with the reorganization of activities, notably a gradual decrease in agricultural activities. During this process the distinction between urban agglomeration and rural settlement becomes unclear. This phenomenon can entail widespread and massive urbanization – quite unlike



Monshaat Al Bakkari: an absorbed rural village on the periphery of Cairo (Egypt). SWAC/OECD (2020)

natural agglomeration growth that leads to a more gradual urbanization.

These rural transformations also challenge the influence still attributed to rural exodus and residential migration in driving urban growth in Africa. If in the past the primary driver for urbanization resulted from centripetal flows of people migrating from rural areas to urban zones, urban growth today is a result of centrifugal movement (sprawl) rather than natural growth in rural areas (*in situ*). This shows the importance of carefully studying today's rural areas if we are to understand the urbanization of tomorrow.

THE PLACE OF INLAND CITIES

In most representations and discourses relating to African urbanization, we can note the considerable importance accorded to coastal agglomerations. However, 75% of Africa's city-dwellers actually live in the continent's interior.

Most major colonial cities – the entry points to Africa used by colonial powers – were ports, and these are the foundation of many of today's most populous African agglomerations. But in reality, many cities have only limited contact with the coastline: at the local scale, in many cases constructions along the coast tend to face inland. And if we

examine the coastline, it becomes clear that its occupation is discontinuous and uneven. The West African urban corridor, cited above, shows that urban concentrations only occasionally follow the coastline, quite unlike the far more consistent urban build-up along the coastline of other continents. These observations reveal a shared characteristic of African societies, which were historically primarily pastoral and agrarian. Coastal development is a

A great many of the agglomerations revealed by Africapolis are not recorded in official statistics. This concerns agglomerations of all sizes, some in excess of a million residents

recent phenomenon in Africa that should not be ignored, but neither should it be over-stated.

There is, at the same time, increasingly strong urban growth in the interior. Inland regions are seeing the emergence of secondary agglomerations, political capitals as well as spontaneous mega-agglomerations. Africa's main historical settlement areas are in its interior, and the indicators show that these territories are where there is the highest potential for urban growth. The capitals of 17 landlocked countries display urban growth that is just as rapid as that of countries with a coastline. Some of the intermediary agglomerations of the interior, such as Touba in Senegal, Kumasi in Ghana and Bouaké in Côte d'Ivoire, have become major secondary agglomerations and compete with national coastal metropolises.

The bipolarity of urban growth, coastal versus interior, shines a light on the political consequences of urbanization: it could be accompanied by a shift in socioeconomic and political power from the coast and toward the interior. The primary challenge resulting from this change is to improve connections between urban networks and to approach integration from a continental and regional point of view.

OUTLOOK FOR 2030

The urban trends over the past 15 years described by Africapolis seem set to continue: urban networks will continue to densify, today's rural areas and small agglomerations will be the large urban zones of tomorrow, new mega-agglomerations will appear, and so on. What is harder to anticipate is precisely when and to what degree policymakers and development partners will adapt to harness the potential of these changes.

INTEGRATING THE NEW REALITIES INTO PUBLIC POLICIES FOR ACCESS TO SERVICES

The work of Africapolis challenges the scale of territorial planning. Most power currently resides with the central state and when some responsibilities are delegated to the local level, they are generally delegated to cities. However, as the analysis undertaken by Africapolis shows, these administrative entities are often poor reflections of the spatial and morphological realities of agglomerations, and they struggle to integrate phenomena relating to spontaneous urbanization.

Hundreds of officially unrecognized agglomerations, and thus their residents, have far lower political profiles at the national level, meaning less support and fewer resources from the central state. And even where secondary agglomerations are recognized as such in national

statistics, there remain distortions that favor major agglomerations: access to drinking water, for example, is generally considerably better in the metropolises than the rest of the country, including in other urban areas.

Without recognition and an accurate overview of urban dynamics, states are incapable of fully understanding their

territories and the breakdown between the various settlement zones, and therefore the requirements for each zone. In terms of policies for access to services such as water and sanitation, these are very large-scale, long-term projects. This makes it all the more important to anticipate demographic and urban change.

African urbanization cannot be understood simply by studying a sample of large cities, nor is it simply a matter of urban versus rural

CONCLUSION

Africa is the fastest urbanizing continent in the world. Cities play, and will continue to play, an essential role in the continent's development. Using a spatial approach, the Africapolis database analyzes little-studied processes at work in this urban transition: rural transformations, the emergence of spontaneous mega-agglomerations, blurring of boundaries between rural and urban, the emergence of secondary agglomerations, urbanization away from coastal regions, etc. The failure of national statistical frameworks to recognize many cities – including intermediary cities which have a significant role to play in the development of national and continental urban networks – is the source of major imbalances, particularly in terms of resources and capacities.

These unique processes and urban dynamics demand development policies that are in alignment with the realities of urban Africa, particularly in terms of access to services. The challenge now facing policymakers is to take ownership of these newly available data and put them to good use.

THE QUEST FOR EFFICIENT WASTE MANAGEMENT ARCHITECTURE IN GHANA

Martin Oteng-Ababio

Professor in urban geography and the Head of Department of Geography and Resource Development, University of Ghana



Martin Oteng Ababio is a professor in urban geography and the Head of Department of Geography and Resource Development, at University of Ghana. His research interests span broadly from urban studies with a specialty in the waste economy and environmental management and policy, and waste-induced entrepreneurship. Prof Oteng-Ababio has demonstrated considerable competence at publications, having authored over 85 peer-reviewed journal articles and 20 book chapters.

In the quest for efficient waste management system in Ghana, authorities' 'waste war' adjudication strategies have ignored the historical focus on socially all-inclusive planning designs. Instead, approaches adopted so far unduly promote a market-led agenda making the public good nature of waste largely ignored. A careful consideration of how each society engages with service provision and its normative dimensions should be put at the centre of waste policies. Such approach transcends ideology and institutional exigencies and moves towards the realm of practical reason, everyday ethics, and embodied practice. Until the evidence—along with institutional and financial instruments—shows otherwise, city authorities' will do well to integrate proven innovative management practices taking place 'in their backyard'.

INTRODUCTION

The quest for an efficient solid waste management (SWM) system in Ghana has a colonial antecedent. The campaign emerged when the need for environmental protection in spatial planning practices became imperative. Pointedly, increased population growth and economic development led not only to increased volumes of municipal waste significantly, but also its composition (Mieza et al., 2015). Being a social problem, the menace of waste has neither spared the developed nor developing nations but the problem is more pervasive in developing economies, where the challenge is generating more pressure on existing environment and human health.

Since its inception, the SWM trail has been bumpy, exhibiting occasional transformations in tandem with changing volume and content of waste, as well as technology. Nonetheless, very limited studies have investigated the historical geographies of SWM strategies and their outcomes. Largely overlooked are the effects of these dynamics on the urban fabric and its social structure, especially in questions related to the inequality of service provision and how that can inform future policies.

SWM – FROM COLONIAL TIMES TO THE PRESENT

The troubled history of unsanitary conditions in Accra can be mainly attributable to policy failures. This has provided an opportunity to dig into history to shed light on factors influencing policy development outcomes, and the politics of policy retrenchment to guide future policies. The first [epoch] sustained, non-infrastructure foray into environmental sanitation came on the heels of the growth of Accra, dating back to the early 16th century, albeit in an unplanned manner. Demographically, Accra's total population increased from 18,574 in 1911 reached 337,828 in 1960, and by 2010, had passed the 3 million mark¹. With increasing population, the authorities experienced the tension of addressing both the pro-growth and pro-poor agenda, leading to the establishment of the Accra City Council (ACC) in 1898, which was charged with the responsibility to keep the city clean.

The initial policy reforms—then based on European principles and legal regimes—created the two faces of Accra: the European and traditional (native) towns². This division was maintained exclusively through a rigid policy of residential segregation via a cordon sanitaire of vacant land, with the 'local' merchants occupying the Native Town, and the Ridge area hosting the European Town. With time, the two 'towns' developed extremes in living conditions, from an over-crowded, disorganized, chaotic, and unsanitary Native Town, to an exclusive, expatriate European and African elite enclaves of European Town.

Although the duality was the planning choice of the colonial administrators, their policy on sanitation considered waste as a 'social good' and avoided creating a sanitation nightmare, and by and large evinced inclusivity (not exclusivity). By 1925, while the European towns enjoyed a household collection services, public dustbins were introduced in the Native towns and emptied by means of two pushcarts managed by labourers. The authorities also promoted the use of sea water to occasionally disinfect drains in the European Town and the stagnant water spots in the Native enclaves. There were also environmental health inspectors who conducted house-to-house monitoring to check whether the laws on health and hygiene were being adhered to; and when found culpable, offenders were prosecuted uncompromisingly³.

Further, few sites located on the outskirts of Accra served the purposes of final disposal until in 1929 when incinerators manned by a sanitary man who powered the incinerators into action were introduced. By the late 1950s and shortly after independence in 1957, the existing infrastructure became stressed, resulting in a total

breakdown of the only incinerator by 1970, which then led to the crude dumping of waste into quarry pits at Aborfu, Achimota, and Abeka in Accra. This technically marks the end of the first epoch of SWM trajectory, a period when waste was contextualised as a public good and when the institutional arrangements exhibited an all-inclusive participatory process.

The early 1970s ushered in the second epoch; a phase during which the city authorities introduced two systems of refuse collection as part of an effort to streamline and respond to the challenges accompanying increasing population growth. Through prescriptive planning, the then high-income, low-density, planned areas—such as Laterbiokorshie, Ridge, and Kanda—had hand collectors using wheelbarrows to collect refuse from house-to-house in return for monthly fees. However, residents living in lower-income, high-density, unplanned areas were to dump waste at no cost at central points, to be collected into side loaders by labourers. The authorities' inability to mobilize sufficient revenue to meet the embedded financial obligations in this strategy led to a pile-up of refuse in low-income areas, whose unplanned growth the authorities themselves had supervised, with every open space having been haphazardly developed into 'residential accommodation', including the use of containers and kiosks.

In an attempt to improve on the quality of service delivery, which ushers us into the last epoch, the government of

Ghana obtained funding from the Federal Republic of Germany for the Accra Waste Management Improvement project and established the Waste Management Department (WMD) in 1985. The grant also proposed a privatization policy which was expected to leverage private sector expertise

and financial muzzle. This public-private partnership officially remains the policy option today for dealing with the waste challenge (e.g. negative externalities, information asymmetry, natural monopoly), to improve quality of service and to extend coverage to previously unserved area.

Operationally, the institutional arrangement that materializes in a particular area depends on several factors, including income, physical characteristics, the strength of community organization and the general policy of local authorities. Although seemingly amorphous, two primary arrangements can be isolated: the central communal container system (CCC) and house-to-house (HH) systems all provided and run by private sector operators. But, the type (foreign or local) and nature (politically and socially connected) of the service provider have undergone metamorphoses, and the dynamics manifest with changes in government.

Each locality is primarily characterized by one institutional method and one dominant socio-economic status. Ultimately, the characteristics and constraints of a space

There is the need to conceptualise waste as a public good

1 Owusu and Oteng-Ababio, (2015)

2 Songsore, (2017)

3 Songsore, (2017)

significantly shape its institutional arrangements for SWM. Suffice it to add that, the state polices on SWM have changed from central government control of resources and power to a more facilitative role amidst different levels of political and socio-economic environment. The public sector has become the purchaser of services on behalf of citizens, while the private sector has taken on an increasing role as the provider of public services and obscures SWM's status as a public good⁴.

RAMIFICATIONS OF SOLID WASTE POLICY INITIATIVES

The assessment of a SWM system provides city authorities with an opportunity to re-evaluate performance and seek policy adjustment. The Local Government Act 624 (1993) and the environmental policy (2010) guarantee everyone with the right to a clean environment—albeit till date, services remain unevenly provided across cities⁵. Under Act 624, the WMD is to produce SWM operational plan to progressively ensure efficient, affordable, and sustainable services, while the central authority holds regulatory responsibilities. However, the responsibility for service provision has shifted over the past 30 years. Under the present prescriptive rights-based SWM discourse, tempered as it is with a neo-liberal cost-recovery approach, implies that not everyone will be able to pay for the right services. This raises concerns about whether the focus of the service is on cost-recovery or on the pursuit of social and environmental justice (public good).

The consequence of the current architecture manifests conspicuously within cities. In Accra for example, residents in the low-income, unplanned areas (constituting about 74% of the population) seem to have been declared persona non grata. This large segment of the population remains physically situated within, but conceptually outside the city boundaries, having been virtually excluded, and enjoys hardly any decent services—even though 'concern for the ordinary people remains an over-flogged political mantra. In truth, the current socio-economic realities and the adoption of the conventional 'polluter-pays principle' mean that the polluter either pays for his waste to be disposed of, or finds a way. In Accra, evidence abounds that city authorities have over the years loudly touted their commitment to maintaining a clean environment, and have sometimes openly denounced policies that pursue selectivity in service delivery at the expense of universalism. Yet they have neglected underserved communities including Abuja, Agbobbloshie, and Glefe, which still exist as conspicuous eyesores.

In seeking an innovative way to see, think, and understand the waste war and perhaps build one of the cleanest cities in Africa, there is a need to first question what went

wrong and what has been assumed thus far. The challenge is not simply to call for fresh and improved solutions; and, indeed, it is not a problem at all—if by 'problem' is meant an issue separate from the society which must be confronted, deconstructed, and solved. As the French philosopher Gabriel Marcel would argue, we deal here with a 'mystery'—a situation in which we are inextricably involved, and in which we must call ourselves into question if we are to again see clearly.

CONTINUOUS UNSANITARY CONDITIONS IN ACCRA: A CASE OF POOR PROGNOSIS?

The year 2014 stands out in Ghana's annals as the year of an unmatched outbreak of cholera (20,279 cases), which led to the loss of life of 169 people⁶. The outbreak was quite perilous, precipitating the government to initiate a National Sanitation Day (NSD) in November 2014. Clearly, such an embarrassing and lethal sanitation situation stands in sharp contrast to what pertained in the colonial era and shortly before independence, which was a 'technology- and energy-starved' period. Significantly, the managers of the city then saw waste as both a public good and a resource, and instituted a SWM system that was economically feasible, socially acceptable, and environmentally friendly.

A demonstrable policy reality in the recognition of waste as a resource for example, was the establishment of the Teshie Compost Plant (TCP). Conceived around the late 1950s, enduring 'years of stressful ectopic', and finally delivered in the late 1970s, the plant produced compost fertilizer from household organic waste. The paucity of data notwithstanding, available records indicate that the plant since its inception never operated at full capacity, with production capacity falling from about 92% capacity in 1995 to only 11% in 2004 (see Figure 1).

Although the TCP failed, it offers very useful lessons for the future policy development. The plants for example failed primarily owing to a lack of source-separated feedstock, which resulted in the production of insufficient quality compost (composted mixed waste). This led to continual mechanical failure, which was exacerbated by the conditions of a technology that had long exceeded its useful life. Thus, 'if the reasons for the demise of the plant had been well digested, it could have held the key to the success of any future compost plant like the Accra Compost Plant [ACP]'⁷.

The Accra Compost and Recycling Plant was established in 2012, through a public-private partnership programme. The company has the capacity to process close to 600 tonnes of municipal waste per day, but operates less than 60% due mainly to inappropriate feedstock. The company's challenges are technically no different from those faced by

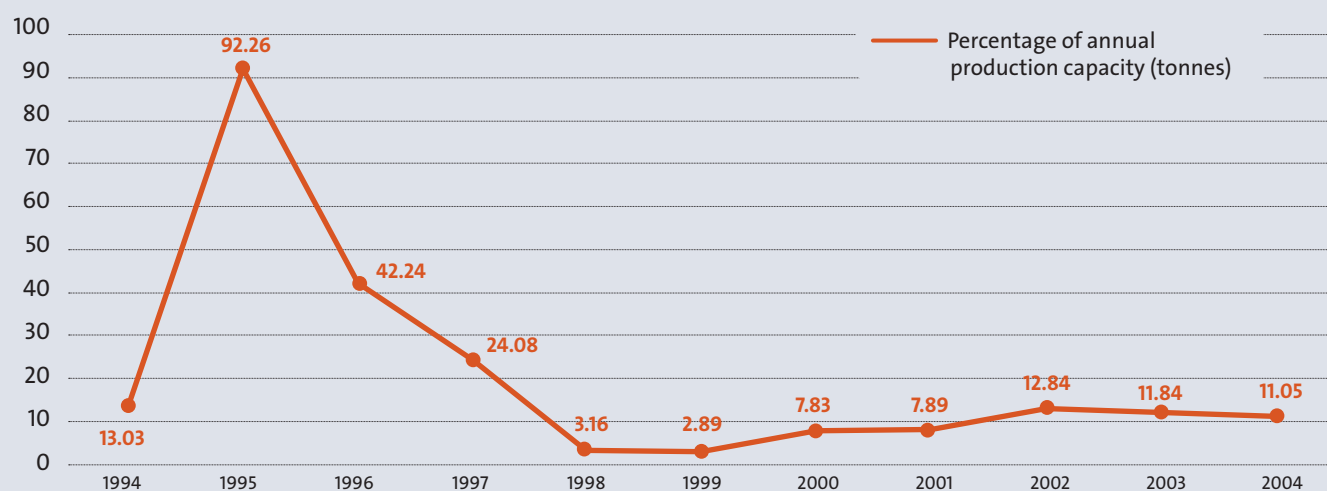
4 Oduro-Kwarteng and Dijk, (2013)

5 Oduro-Appiah et al., (2017)

6 Amoakohene, (2015)

7 Personal interview; October (2016)

Annual production levels of Teshie Compost Plant, 1994–2004



Source: Oteng-Ababio et al., (2013)

Figure 1

the Teshie plant. For example, today, due to lack of source-separated feedstock, ACP encounters about 30% faecal matter in its feedstock, which has compelled the company to stop accepting waste collected from low-income and market areas.

Contemporary analysis of the Ghanaian economy shows strong signs of improvement—with an annual gross domestic product growth of 5.7% per capita⁸ - and witnessing an immense technological transition, yet when it comes to issues on SWM, most citizens appear despondent on the basis of past experiences. In particular, the government's market-oriented prescription has virtually condemned the poor residents to a perpetual war with filth and unsanitary conditions.

In terms of waste disposal, the present strategy, where waste is dumped on neglected, non-systematic disposal sites without pre-treatment, and causing significant pollution in the immediate environs is unacceptable. Within the last two decades, Accra has witnessed the commissioning and decommissioning of not less than 11 dumping sites.

Typically, almost all local landfills do not meet the basic sanitary and technical standards and have become unsanitary, presenting risk both to humans and the environment. This development has created a situation where the public is questioning whether landfills constitute “a blessing or a curse” to the people they are meant to serve. The situation has aggravated the rate at which the city administrators commission and decommission the landfills without regard to public health.

Evidently, the recent SWM approaches—often foreign-dependent—have so far yielded few results, as they mainly remain incompatible with local socio-economic realities. This situation is likely to persist and even worsen until and unless the imported solutions are integrated with all-inclusive indigenously derived strategies, something the authorities have failed to do till date—or failing to do correctly. It is therefore high time the city authorities innovatively planned directly with these communities and their inhabitants.

GETTING THE FUNDAMENTALS RIGHT

The history of SWM practices, and after the introduction of the PPP, which embraced foreign paradigms, has consistently failed to achieve set targets. The reasons for this could include the social (mis)construction of the appropriate architecture, and the dramatic changes in waste volume and content. Consistently, most past strategies tend to evoke knee-jerk solutions, instead of solutions based on empirically-driven content-analysis, solutions that are the product of consultative, socio-economically, and politically-inclusive processes—and which at the very least, and as a matter of urgency, protect the interests of all including the poor. Simply put, there is a need for an all-inclusive policy initiative based on scientific research, without which the deteriorating situation will frustrate the quest to make Accra one of the cleanest cities in Africa. There is the need to conceptualise waste as a public good to help uncover the fatal flaws impacting the industry as discussed below.

RE-THINKING WASTE AS A PUBLIC GOOD

The quest for sustainable SWM is a coherent objective everyone supports. But there is less consensus on

8 Mieza et al., (2015)

how exactly this should be done, and the process, conceptualised. To date, the experimented policy initiatives have been largely fruitless, and the results are clearly visible in cities. Instead of adopting one-size-fits-all conventional approaches, city authorities should examine every strategy in its empirical dimensions in order to reveal the range of actual and potential policies that work to 'articulate and aggregate identities, interests and preferences'⁹.

Conceptually, seeing waste as a public good must be 'municipalised' in order to avoid creating greater societal costs¹⁰. Yhdego (1995) reveals that lack proper sanitation can have double the rate of diarrhoea and six times the rate of respiratory disease. This raises concern about the adoption of the 'polluter-pays' principle as a funding strategy. To say that the approach has worked well in developed countries is not at all to suggest that this is a permanent condition or will always, magically, work the same way everywhere else. Put differently, the simple invocation of the polluter-pay-principle as an all-purpose funding mechanism for SWM can never be enough.

Mariwah (2012) notes that with such an arrangement, deprived communities are often poorly served owing to their inability to pay; thus, contractors often simply fail to collect from those areas¹¹. Moreover, payments exacted from the citizenry do not typically cover SWM in large public spaces as well as treatment and disposal, thus compromising service providers' liquidity positions and encouraging situations where waste gets dumped illicitly. Given the socio-economic realities in Ghana, it appears ethically challenging to adopt a user-fee approach to generate sufficient revenue to cover the full costs of a SWM cycle. This makes a compelling case for considerable government intervention and subsidy to ensure that poorer and public areas are well served to ensure public health.

DATA DEFICIENCY

Technically, instituting an efficient SWM system necessitates understanding the waste generation rates, on-site handling and storage systems, collection and transport, processing and recovery, recycling and reuse, treatment, and final disposal. These informalities, particularly getting reliable estimates of waste generation rates and types are vital for effective planning and taking better financial, regulatory and institutional decisions. There must be sources where data collection is transparent, and consistent enough to enable accurate measurements over time. Such accurate and reliable data 'is the link between good planning and good results', or the sine qua non for designing and implementing any efficient system. Unfortunately, the last time Ghana witnessed a comprehensive waste audit was more than 30 years ago. The official data in use today are projections made back in 2003 using the 1993 nationwide waste audit (see Table 1).

⁹ Agnew, (2017: 347)

¹⁰ Cointreau-Levine (1994); Yhdego (1995); Hoornweg and Bhada-Tata, (2012)

¹¹ Nunan and Satterthwaite, (2010)

Waste composition analyses conducted in 1993 and 2003

Waste fractions	Percentage fraction (%)	
	1993 (WMD)	2003 (WMD)
Organic material	72.6	65.0
Inert material	8.9	17.1
Solid plastics	1.3	3.5
Plastics bags, foils, etc.	2.7	-
Glass	2.0	3.0
Paper & cardboard	7.2	6.0
Metals and Cans	2.8	2.5
Textiles	1.5	1.7
Miscellaneous or other Waste	0.9	1.2
TOTALS	100	100

Source: Oteng-Ababio, (2010)

Table 1

The lack of up-to-date data creates situation where various studies, based on their limited micro data, yield contradictory figures. For example, while Tsiboe and Marbell quote the total daily waste generation in Accra in 2000 as 1,800 tons, the regional administration quotes 2,200 tons. The challenge is not only the difficulty of obtaining reliable data at the right time, but also getting disaggregated data to facilitate intra-community inequalities analysis and track any changes. Ultimately, the lack of such nuanced data can provide misleading information and, inadequately informed and even badly misinformed policy prescriptions.

OVER-RELIANCE ON FOREIGN INPUT

The recent policy of city authorities with foreign institutions, approaches, and methodology, as against building the capacities of local institutions has also affected the drive for sustainable SWM practices. Essentially, such foreign paradigm shifts not only call upon the authorities to enact 'light-touch' regulations such as tax exemptions and to improve the physical environment to attract foreign business, but also provide fertile breeding grounds for corruption and cronyism. One such ill-fated policy was AMA's 7-year service contract with the Chagnon City and Country Waste Ltd (CCWL), signed on 4 December 1997, after securing a Canadian Government credit facility of US\$14,630,998, meant to purchase waste service equipment. The AMA later contracted CCWL and agreed to pay an amount of \$30.28 per tonne of solid waste collected and managed at the landfill site. Though the initial contract left no room for local private participation, the CCWL later sub-contracted to local contractors at \$5.20 (payable in Cedis) per tonne of waste sent to the dump site; yet CCWL was being paid \$22.17 in accordance with the contract signed with the AMA (Oteng-Ababio, 2010).

There is a need for a moral authentication to question the appropriateness of a wholesale adoption of foreign-based 'promising' technologies—which are often incompatible with local realities. There is a need to re-evaluate an ethical-business relationship (or state-sponsored monopoly) that creates instruments of authority and control for 'foreign' businesses over 'local' ones. Rather, city authorities ought to innovate, enhance and integrate 'home-grown' capacities and approaches into its SWM architecture. This is born solely out of their demonstrable practical successes—especially regarding the practices of 'private', informal waste pickers in attracting and collecting household waste within high-density and poor spatial layouts, frequently separating waste at source and recycling it. Ultimately, the economic legitimacy for integrating local content can be appreciated when viewed against the fact that, to date, there are very few success stories of effective management practices using foreign models within Ghana and the sub-region in general.

CONCLUSION

Several issues of policy relevance have been raised, not least the need to engage in proper conceptualisation of waste as a public good and to obtain well-established public and private data sources that are transparent, accountable, and consistent enough to enable accurate measurements over time. Perhaps now more than ever, with a worsening 'waste war', the need for networked modes of governance is imperative.

These modes of governance, whereby authorities and service beneficiaries work co-operatively, will include acknowledging the limitations inherent in the foreign SWM models, limitations that make them unfit for purpose in the way they have been implemented in waste management in Accra. Policy makers should appreciate the potential of local solutions, based on local conditions, knowledge, and traditions, and realise that solutions cooked up in distant, unrelated foreign countries can, at best, provide guidelines and ideas. Ultimately, for solutions to really work in practice, local residents must feel that they own these solutions, that they have a major input into crafting them, and that the solutions originate from their best understanding and wishes for their future.

In conclusion, suffice to state that there is no instant cure for these diverse and complex SWM problems, nor is it a simple case of one-size-fits-all. It is hoped that both public and private practitioners, (formal and informal) will be able to design policies that, at the very least, avoid repeating past mistakes and set new benchmarks for effective all-inclusive strategies. Ideally, the future of SWM must be shaped by the lived experiences of all households and firms and must strive to achieve the following functions:

- Offer a reasonable trade-off between the costs and benefits of compliance,
- Reflect the current context,
- Be the product of consultative, inclusive processes,
- Be economically and politically inclusive,

- Protect the interests of the public, particularly the poor,
- Promote stable and sustainable urban governance,
- Build strong social contracts between state and non-state actors,
- Be designed so that even a relatively fragile city body can effectively implement them.

Based on the evidence of the activities of informal waste service providers, some low-income communities have amply demonstrated they have inherent abilities and skills among their own 'professionals' to substantially win the war against waste. What is now required is an unbiased appreciation that less orthodox approaches may be viable as routes to creating an efficient SWM architecture to win the waste war and 'build one of the cleanest cities in Africa'.

REFERENCES

- Agnew, J. (2017). The Tragedy of the Nation State, Territory, Politics, Governance 5(4): 347-350
- Amoakohene, F. (2015) National Sanitation Day, the Way Forward; GhanaWeb; Tuesday, March 3. <https://www.ghanaweb.com/GhanaHomePage/features/National-Sanitation-Day-the-Way-Forward-348900?channel=D1>
- Cointreau-Levine, S. (1994). Private sector participation in municipal solid waste management in developing countries In The Formal Sector, Urban Management Programme Policy Paper No. 13, Vol. 1. Washington: World Bank.
- Hoornweg, D & Bhada-Tata, P. (2012). What a Waste: A Global Review of Solid Waste Management. Urban development papers no.15. World Bank, Washington DC.
- Mariwah, S. (2012). Institutional Arrangements for Managing Solid Waste in the Shama-Ahanta-East Metropolis. Ghana. Journal of Sustainable Development in Africa 14(6): 292-312.
- Miezah, K. Danso, K. O, Kadar, Z., Baffoe, B & Mensah, M. (2015). Municipal Solid Waste Characterization and Quantification as a measure for effective waste management in Ghana. Management, <http://dx.doi.org/10.1016/j.wasman.2015.09.009>
- Nunan, F. & Satterthwaite, D. (2010). The Influence of governance on the provision of environmental infrastructure and services for low-income groups. International Planning Studies 6(4): 409-426
- Oduro-Appiah, K., Scheinberg, A., Mensah, A., Afful, A., Boadu, H. K., & de Vries, N. (2017). Assessment of the municipal solid waste management system in Accra, Ghana: A 'Wasteaware' benchmark indicator approach. Waste Management Resource 35(11): 1149-1158.
- Oduro-Kwarteng, S. & Van Dijk, M. P. (2013). The effect of increased private sector involvement in solid waste collection in five cities in Ghana. In Waste management & research 31: 81-93.
- Oteng-Ababio, M; Arguello, J E M and Gabbay O (2013) Solid waste management in African cities: Sorting the facts from the fads in Accra, Ghana. *Habitat International*, 39, 96-104
- Oteng-Ababio, M. (2010) Missing Links in Solid Waste Management Practices in the Greater Accra Metropolitan Area (GAMA) in Ghana. *GeoJournal* 76 (5), 551-560
- Oteng-Ababio, M. (2014). Rethinking waste as a resource: Insights from a low-income community in Accra, Ghana. *City, Territory and Architecture* 1:10
- Oteng-Ababio, M. (2019) Technology must seek Tradition: Re-engineering Urban Governance for Sustainable Solid Waste Management in low-income Neighbourhoods. In Future Directions in Municipal Solid Waste Management in Africa, Romeela Mohee and Thokozani (Eds.). African Institute of South Africa.
- Songsore, J. (2017). The Complex interplay between everyday risks and disaster risks: The case of the 2014 cholera pandemic and 2015 flood disaster in Accra, Ghana. *International Journal of Disaster Risk Reduction* 26: 43-50

THE TOILET: UNMENTIONABLE HUMANITARIAN OBJECT OR LUXURY GOOD?

Tatiana Thieme

Urban geographer and associate
Professor, University College London

Justin De Koszmovszky

Partner, Archipel&Co



Mathare toilet, 2009 - ©Justin De Koszmovszky

Tatiana Thieme is an urban ethnographer and Associate Professor based in the Department of Geography at University College London. Her research focuses on urban 'hustle' economies in precarious urban environments, and includes research on the politics and business(es) of waste and sanitation in the global South.

Justin DeKoszmovszky is a partner at Archipel&Co where he leads the sanitation practice, focused on market-based solutions. Justin is also the co-founder of Community Cleaning Services, a social micro-franchise focused on shared toilet-cleaning across Nairobi.

Sanitation practices and infrastructures vary across the world, yet the perceived imperative to separate ourselves from our own bodily waste is universal, based on understandings of public health and cultural taboos associated with all 'waste', that which reflects loss of value and potential contagion¹. The management of human waste, historically and geographically, reflects people's relationship to their bodies, their environment, their government, and their economy². Hence, the lack of adequate sanitation, for 4.2 Billion people³, is cause for alarm and mobilisation. This article investigates the significance of the toilet, the symbolic and material site for intervention against sanitation poverty in the 21st century. What are the implications of the toilet being re-imagined simultaneously as a humanitarian object, an aspirational private consumer good, a public gathering place and a shared commons in countless neighbourhoods in rapidly growing cities of the global South?

INTRODUCTION

Since 2001, on November 19th, World Toilet Day has turned what has often been perceived across cultures as a profoundly private if not taboo subject (shit), and the prosaic, non-object that was once exhibited as a Dadaist provocation by artist Marcel Duchamp (the toilet), into a crucial public awareness raising campaign. UNICEF and an increasing constellation of actors across the development and private sectors have been encouraging the world to 'give a shit' about sanitation, mobilising *the toilet* as a tangible focal point for addressing water and sanitation poverty, the 6th Sustainable Development Goal, associated with public health challenges of the 21st century.

¹ Douglas, Mary 1966. Purity and Danger: An analysis of the concepts of pollution and taboo.

² Laporte, Dominique 2000/1978. History of Shit. Cambridge, MA: MIT Press (translation by Nadia Benabid and Rodolphe el-Khoury)

³ WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply, Sanitation and Hygiene, 2019: Available here: <https://www.who.int/news/item/18-06-2019-1-in-3-people-globally-do-not-have-access-to-safe-drinking-water-unicef-who>



World Toilet Day posters

Undeniably, sanitation merits heightened global attention. Poor water quality and sanitation are leading causes of mortality and disease in developing countries with 4.2 billion people ‘lacking safely managed sanitation’ according to the World Health Organisation. With urban populations growing to unprecedented scales in the global South, municipalities are often under-resourced and unable to cope with the upgrading needs of outdated sanitation infrastructures in neighbourhoods that are still contending with historical legacies of uneven urban development. As a result, many crowded popular neighbourhoods, are systemically cut off from basic sanitation services, and have had to resort to ad hoc and improvised sanitation solutions, from building precarious ‘hanging toilets’ to resorting to open defecation when existing toilet facilities are too far, too costly, or too dirty and malodorous.⁴

Here it seems important to reflect for a moment on the implications of the ‘toilet’ becoming the poster child not only of sanitation challenges but also one of the symbolic and material claims to what Henri Lefevre called ‘the right to the city’ (le droit à la ville). For many urban residents, the most basic bodily (and many might argue, private) matter is rendered highly public (George 2008). It is now well known that more people today have access to a mobile phone than access to a safe toilet option⁵, a shocking paradox of modernity. The toilet, in all its forms—from aspirational good, to site of dilapidation, to its very absence—has become the emblem of urban precarity and embodied vulnerability. Over the last decade especially, the toilet has become a topic that lies at the nexus of humanitarian, public health, educational, urban planning, technological and business concern. As such, the call to care, to innovate, to mobilise, and to research has turned the toilet into both a kind of humanitarian object⁶ and a luxury consumer good.

Humanitarian objects tend to provide a technical fix to a development problem while consumer goods tap into perceived needs and aspirations. As the toilet embodies both, questions of ‘access’ become public and political, but also an assumed matter of private and individual behavior, choice, and status. Therefore, the toilet can be regarded as simultaneously an individual human right and an aspirational good. This focus on the individual person and the individual household implies that addressing the sanitation problem comes down to the lack of individual toilets. Yet, for many low-income (especially urban) residents in the global South, the in-home toilet remains a distant reality and is not necessarily aspirational given the compact and multi-functional nature of the home. For many of these urban residents, the production of cleanliness and privacy associated with sanitation is less a matter concerning the household unit and is more a matter of shared, communal infrastructure and behavior. In the context of shared facilities, the ‘public’ (rather than



Waiting at the public toilet-Pune 2016 - ©Tatiana Thieme Nov 2016, Pune

4 Archipel&Co, Bill and Melinda Gates Foundation and Firmenich, “Malodor & Sanitation Behaviors in Low-Income Settlements,” 2019: Available here: https://archipel-co.com/wp-content/uploads/2019/12/BMGF-Malodor-Sanitation-Global_report.pdf

5 https://news.un.org/en/story/2013/03/435102-deputy-un-chief-calls-urgent-action-tackle-global-sanitation-crisis#.UU_G_BySV3-

6 See 2018 special issue in LIMN on Little Development Devices and Humanitarian Goods: <https://limn.it/issues/little-development-devices-humanitarian-goods/>



Unenclosed toilet in Cape Town - ©Jaco Marais from online

in-home or private) toilet goes beyond design, hardware installation, infrastructure, and coverage. Toilets reveal the multifarious considerations related to the building, maintenance, management, access, and financing of shared ablution blocks, along with the often less documented but crucial everyday social life involved in making a shared resource work for and serve the needs of multiple end-users. Consider what the toilet (or lack thereof) reveals across three different urban sites.

In one of Nairobi's oldest and largest informal settlements, a local community organiser once explained, "*In Mathare there are very few things that can be said to serve the public good. There is no community hall; there is no secondary school. But one of the things that you could say, it is ours, it belongs to us, is the public toilet.*" Against the backdrop of rapid and makeshift urbanisation amongst countless low-income urban citizens, toilets and the sanitation commons can be highly politicized, social, and contested spaces, sometimes more so than housing. In low-income settlements especially, the toilet (or lack thereof) represents a dramatic form of embodied and gendered insecurity, rendering women and children most vulnerable⁷. Given that these shared resources are crucial public facilities, for some politicians and development actors in Nairobi, toilets have even become symbols of 'good will' and visible investment. But despite the shiny plaque on the outside wall featuring a date and the name of a sponsor, these humanitarian objects, too often created as sanitation prestige projects with minimal forethought to sustainable management, are too often left ill-maintained, eventually breaking down physically and socially⁸. In contrast, there are community groups, often youth groups, who have taken pride in managing and cleaning shared toilets in Mathare to serve the surrounding community, in exchange for an affordable pay-per-use or monthly fee. While introducing a market mechanism to a basic need in an already low-

income neighbourhood can be seen as yet another poverty penalty, residents that pay for access to a communal toilet can expect a certain standard of cleanliness and be assured that this shared facility is not only managed and cleaned in the first place, but that it is also generating a source of income for under-employed youth. Some of these well-maintained communal toilets have served as much more than a mere sanitation facility. In one neighbourhood of Mathare known as 'Number 10', the shared toilet managed by a local youth group for the last 10 years is today adjacent to a water point, a mobile banking kiosk, and an urban sac farm—all investments made by the youth group with toilet income and on toilet traffic. In other words, the toilet in this case has served as a trigger for various income-generating activities that have turned a site of 'waste' into multiple kinds of value.

The story of Cape Town, South Africa, reflects a different political direction to the Nairobi case: In 2013, the degrading state of toilets in low-income neighbourhoods, like Khayelitsha, became a politicised artifact representing poverty, inequality, and broken promises. Two decades after the end of Apartheid and the associated hopes for a better life for all South Africans, the infamous portable toilets or 'portaloos' and the 'unenclosed' toilets became the object of sanitation activism. Protestors brought these demeaning toilet structures and their contents into the city centre streets, using this politics of disturbance to voice grievances against inadequate basic service provision in informal settlements on the periphery of the city. In this case, the toilet was neither a humanitarian object nor luxury good, but rather a symbol of indignity, an absentee state, and persistent uneven allocation of resources. In 2015 these 'poo wars' extended to the 'Rhodes Must Fall'



Shared toilet in Pune 2016 - ©Tatiana Thieme Nov 2016, Pune

7 Amnesty International (2010), *Insecurity and Indignity: Women's experiences in the slums of Nairobi*. Available here: <https://www.amnesty.org/download/Documents/36000/afr320022010en.pdf>

8 Thieme, Tatiana 2018. "Water is life, but sanitation is dignity", LIMN, special issue on Little Development Devices.

student protests at the University of Cape Town, which contested the over-bearing and oppressive presence of English white colonial references across the campus. As a visible marker of persistent and structural racism in the urban landscape, human waste from a dilapidated portaloo from Cape Town's poor urban neighbourhoods became the connection between inadequate sanitation and anti-poverty, anti-colonial and anti-Apartheid struggles. In this context, the embodied 'politics of shit' and the degrading toilet operated as a shaming device directed towards the public sector, in a context where there were particular expectations directed towards the post-Apartheid state. This contrasts with the case of Nairobi where so many residents from under-resourced neighbourhoods have for many decades resorted to 'self-help' solutions⁹ because they have either been let down by the state, or know that waiting for upgraded infrastructures is usually not an option¹⁰.

In Pune, India, the toilet is not a humanitarian object provided by private donors or a matter of contestation towards an absentee state. The toilet is a middle-class luxury good and a powerful political tool. The well maintained toilet became a symbol of dignity during under the leadership of India's non-violent independence movement against British rule, Mahatma Gandhi. And today, the current Prime Minister of India Narendra Modi has, since 2014, promoted a nation-wide movement known as Swachh Bharat to ensure widespread access to a toilet across rural and urban areas. However, during a perception study of everyday experiences of sanitation conducted by Archipel&Co in 2016, we found that for lower-income households did not necessarily want sanitation to be brought indoors, even if an in-home toilet were provided. For most low-income households, the home is purposefully and pragmatically modular: the 'bedroom' becomes at different points in the day a kitchen, a sitting room, the workstation for in-home businesses, the after-school homework study, and the site of assembly for self-help groups discussing their saving scheme. The 'bathing corner' is used for cooking one minute and washing your feet the next. In this context, the toilet is set apart from the home not only because it is more convenient, but because it is also considered more hygienic to keep your ablutions far away from your dwelling, despite the very real security concern, particularly for countless women and children, when they face a long walk to the nearest toilet after dark.

These three examples seek to emphasize the diverse meanings associated with the toilet as a constellation of actors and sectors—public, private, civil society—work

towards advancing the Sustainable Development Goals, including improved access to water, sanitation and hygiene. It is clear that for most urban dwellers today, especially in the global South, a private toilet remains a luxury good. At the same time, access to a safe, clean, and reasonably close sanitation facility should be considered an essential

right. Within the current reality, however, the key characteristic of the 'real toilet' for the majority of urban citizens in rapidly growing cities today is the shared toilet, and often a contested commons. Therefore, passionate social innovators across the private, public and development sectors that have in recent years taken on the Gates Foundation's challenge to 're-invent the toilet' need to consider the importance of the collective and social life

that surrounds shared sanitation spaces, from the everyday civilities in the queue to the meaningful ways in which local actors are raising expectations for what might be considered 'adequate sanitation' in their own terms, and in their neighbourhood.

Sanitation projects today, ranging from eco-sanitation to micro-franchise models are encouraging and worthy of praise in their own right. Yet these interventions rely on communities taking an active role in improving their sanitation options. This might include fostering a collective willingness to pay a private sanitation provider or resolving the potential disputes that inevitably occur when any group of people share a common good. Ultimately, to bring about the critical improvements necessary, any sanitation intervention needs to work within the very real urban constraints and pragmatic coping strategies related to compact and modular living. As we enter the third decade of the 21st century, the toilet is perhaps more than ever both a humanitarian object and an aspirational consumer good, where community economics determine the quotidian, often invisible, labour involved in maintaining these sanitation commons. If we reflect comparatively on some of the various examples of sanitation improvement at work, it seems that the most effective way to ensure improved urban sanitation is a combination of infrastructure and "hardware" provision (across public, shared and individual toilets), and the "software" of social and market mechanisms to enable contextual incentives for a shared sanitation ecosystem. This is not an easy balance.

World Toilet Day continues to put a spotlight on the 'unmentionable'¹¹ once a year, but it is important that each time any of us are able to safely access a toilet we remember the profound politics of a prosaic and provincial pee, and recognise that ending sanitation poverty relies on, but also goes beyond, the near-by presence of a toilet for all.

9 Hake, Andrew (1977) African Metropolis: Nairobi's Self-Help City

10 See Robins, S. 2013. How poo became political. The Cape Times (Cape Town). 2 July: p. 9; McFarlane, C. and J. Silver (2016) The Poilitical City: 'Seeing Sanitation' and Making the Urban Political in Cape Town, Antipode; Robins, S. 2015. Back to the poo that started it all. April 9th. The Cape Times.

11 George, Rose (2008) The Adventures of Human Waste.

WATER GOVERNANCE IN A CONTEXT OF SCARCITY

Pr. Houria Tazi Sadeq

Lawyer and chairwoman of the Coalition Marocaine pour l'Eau



Professor Houria Tazi Sadeq is a legal and institutional expert on issues relating to water, the environment and sustainable development. She has a doctorate in law and is chairwoman and founder of the Coalition Marocaine pour l'Eau (COALMA) and has been addressing water-related issues in academia and civil society for 30 years. Founded in 2016, COALMA is a non-profit registered in Morocco that promotes recognition of the vital importance of water within an approach rooted in sustainability and the reality of the climate emergency. She encourages, shares, promotes and disseminates Moroccan initiatives in this field.

Morocco has made access to drinking water a priority for many years. Among other actions, the country has adopted a series of legislative measures and institutional reforms to improve how water management is defined and regulated, remedy inequalities of access, protect water quantity and quality, and reuse it. In large urban areas, innovative mechanisms such as subsidized connections have been put in place to help the most disadvantaged communities. However, the current climate emergency, with its particularly negative impact on water, means we need to rethink the challenges of water and its governance. In a context marked by scarcity, ensuring water sustainability is crucial, as clearly laid out in the Sustainable Development Goals (Goal 6). We must reassess the resilience of how this vital resource is managed by adopting participative, cross-sectoral and interdisciplinary approaches to develop the tools for the governance model now needed: social water management.

INTRODUCTION

Morocco has long prioritized water and government statements as well as a number of concrete actions clearly point to an awareness of the value of water resources. This recognition of water's importance goes hand in hand with a political commitment to organizing and controlling the way it is managed. His Majesty King Mohammed VI addressed the nation on the 19th anniversary of his accession to the throne in July 2018 with a speech that once again underlined the priority status of water as well as its role in stability: "My keenness to improve social conditions and tackle economic challenges is second only to my determination to preserve and develop our country's strategic resources, particularly water. Indeed, the latter plays a fundamental role in development and stability."

Since independence, Morocco has implemented water policies and legislative and institutional measures to improve the regulation of water management and distribution to Moroccans, including the most vulnerable. In the current context of water scarcity and climate change, governance systems for this essential resource have to be rethought.

MANAGING SCARCITY

Natural conditions and a location in an arid or semi-arid region mean water resources are limited and distributed irregularly in time and space. They therefore need to be protected, used and even reused within an effective governance model.

Although a low emitter of greenhouse gases, Morocco is not exempt from warning signs of probable impacts of climate change. All its water comes from the sky,¹ raising the risk of more frequent and intense droughts, flooding, a fall in the level of groundwater and average amounts of water in reservoirs, reduced annual rainfall and perhaps a change in sea level.

While it continues to come under ideological attack, the climate emergency is now an established fact. Water bears the brunt of its effects, which in turn hinder efforts to embrace sustainable development. The early 21st century is undeniably bringing us face to face with a series of complex social, economic, environmental and political changes.

Reports by the IPCC² sound the alarm about the impacts of climate change that will slow economic growth and poverty reduction in low-income countries, further erode food security and create new pockets of poverty even in high-income countries, accentuating inequalities. It is our duty to change our responses and act with greater speed. A series of preventive processes and measures to combat vulnerability while encouraging adaptation has already been implemented. Putting these into practice involves applying the principles of sustainable development to sector-specific strategies and the actions of operators providing water and sanitation services.

The new challenges of the climate emergency add to the more established challenges. For instance, Moroccan cities are now more heavily populated than rural areas for the first time in the country's history. The impact of population growth combined with ever-greater soil sealing caused by urbanization, coastal development and housing build-up in former medinas, and the development of economic activities generate greater and more varied demand, putting more and more pressure on water resources.

In demographic terms, Morocco is now home to 36 million people, up from 20 million in 1980. It took over 50 years for the population to double. Between 1900 and 1952, the population rose from 5 to 9.3 million.

These variables explain, among other factors, the decision to implement a policy designed to endow the country with the necessary infrastructure for exploiting and controlling water (such as the reservoir policy).³ The goal is to optimize

or possibly reuse water, ensure that water is distributed fairly, promote good health and ensure food security.

LEGISLATIVE MEASURES AND INSTITUTIONAL REFORMS IN MOROCCO

Just like the rest of the planet, Morocco has to tackle the thorny questions of how to:

- remedy unequal access to water and sanitation between towns and cities and their different districts, regions and environments (rural regions, substandard housing, and so on);
- ensure and organize distribution between different sectors (domestic, industrial, agricultural and tourism);
- protect the quantity and quality of water resources, which have become scarcer and more vulnerable, and reuse the water that is produced;
- work to ensure that water is a factor for cooperation, solidarity and social peace rather than a source of conflict and/or claims and possible insecurity;
- anticipate the future and ensure sustainability. The processes involved in meeting the Sustainable Development Goals, particularly Goal 6,⁴ and their success depend on the abundance or scarcity of this shared asset.

Morocco has made significant progress and produced several reports and studies that show what remains to be done. These highlight other, complex issues that interact with water and polarize a multitude of problems and challenges that need tackling.

The 1995 Law 10-95 on water⁵ represented a significant step forward by providing a unifying text setting out the basic principles of water management, including:

- public ownership of water;
- uniform water management;
- first recognition of the fight against water pollution and for water regeneration (Chapter VI);
- adoption of the user-pays and polluter-pays principles;
- water management consultation;
- decentralized management by drainage basin;
- recognition of the social, economic and environmental value of water;
- solidarity between users, sectors and regions.

Adopted in August 2016, Law 36-15⁶ confirms and supplements Law 10-95 on water by expanding its normative content and closing a number of loopholes. Its main goals consist of promoting effective water governance by simplifying procedures, reinforcing the legal framework for reusing water,

1 Morocco does not have shared water resources other than the Kiss River, which also runs through Algeria, the Guir and the Figuig aquifer.

2 See the IPCC Special Report on Global Warming of 1.5 °C, World Meteorological Organization, Bulletin no.: Vol 67 (2) - 2018.

3 Morocco has 145 large dams.

4 According to the UN: Goal 6 consists of ensuring access to drinking water and sanitation. It includes targets for protecting and restoring water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes. It also aims to improve water quality and reduce water pollution, particularly pollution caused by hazardous chemicals. Other targets involve expanding international cooperation and implementing integrated water resources management at all levels.

5 Dahir 1-95-154 of August 16, 1995 promulgated Law 10-95 on water.

6 Dahir 1-16-113 of 6 Kaada 1437 (August 10, 2016) promulgated Law 36-15 on water. See also Dahir 1-14-09 of March 6, 2014 promulgating framework law 99-12 covering the national environment and sustainable development charter.

establishing a legal framework for desalinating seawater, strengthening mechanisms for protecting water resources, and improving measures for guarding against extreme phenomena linked to climate change.

The new law extends the use of the public water domain to wetlands, rainwater and stormwater. It also covers the management of water-based risks to improve protection of people and goods as well as the coherent, collaborative planning of water so it can be managed rationally and sustainably, improved and reused.

Other key improvements include: (i) the right of every citizen to have access to water in sufficient quantity and of acceptable quality; (ii) environmental protection and the promotion of sustainable development; (iii) integrated, decentralized, territorialized and participative water management that respects good governance practices, adopts a gender-sensitive approach, and ensures territorial and socioeconomic solidarity.

The new mechanism reinforces quality standards (sanitation) and water conservation (outflows), and allows public-private partnerships. It introduces standards that apply to the construction, maintenance, use and safety of water infrastructure.

The law endorses the principle of integrated, decentralized, collaborative management by drainage basin as established by a new, two-tiered institutional mechanism: at the drainage basin level, with a basin committee, and the national level, with an inter-ministerial commission.

In terms of energy, Morocco is adopting a positive approach by setting a target of 52% renewable energy by 2030 and implementing initiatives linking water, sanitation and energy.

The gradual incorporation of water imperatives into sector-specific policies for new ministerial departments is also under way.

Morocco has become one of the nations that have made water access a constitutionally protected right. This is a major step forward in 21st-century human rights, symbolizing further advances in economic, cultural, social and environmental rights. Globalization has led to the emergence of water on the public stage, where it has become the subject of legal efforts to have it gradually recognized – implicitly then explicitly – as a fundamental human right.

As a highly active international actor, Morocco voted in favor of Resolution 64/292 at the United Nations General Assembly on July 28, 2010. The resolution explicitly recognized the human right to clean, safe drinking water as essential to the right to life and the realization of all human rights. It also voted in favor of further resolutions, entitled “Human rights to water and sanitation” adopted by the UN General Assembly and Human Rights Council, which drew a distinction between the right to water and the right to sanitation. In keeping with

these resolutions, Morocco dedicated article 31 of its 2011 Constitution to the right to water.⁷

The Moroccan approach is based on the binding nature of this right, by linking the right to water to the right to the environment and to sustainable development, paving the way for a holistic approach. Given that sustainable development is rooted in three key spheres – ecological, economic and social – this gives the individual an active role in development that can even be as a mediator between humans and nature. Furthermore, it calls for action that is territorialized, local and gender-sensitive, since it promotes equal access for women and men. The right was again endorsed in the aforementioned Law 36-15 on water.

Nevertheless, the right can only be constructed on the basis of knowledge of water availability and services.

The new institutional provisions introduced by Law 36-15 open the door to consultations between elected representatives, professional associations, user groups, manufacturers, farmers, public establishments and ministerial departments. These actors can then decide on plans, programs and water resource development projects relating to their drainage basin.

The law offers value added due to the rules for its implementation, which can make a considerable contribution to improving sanitation management provided that an effort is made to harmonize them.⁸

Municipal water distribution operators have made targeted use of the private sector in large cities: Casablanca in 1997 with Lyonnaise des Eaux; Tangier-Tétouan in 2002 and Rabat in 2004 with Veolia, alongside, for medium-sized cities, autonomous public corporations that come under the control of the Ministry of the Interior as part of the decentralization process, since the Local Authority Charter gives local authorities the power to decide how local public services should be managed.⁹

7 Article 31 of the 2011 Constitution specifies that: “The State, public establishments and local authorities work for the mobilization of all the means available to facilitate equal access for all citizens, women and men, to conditions that permit their enjoyment of the right to:
• access to water and a healthy environment;
• sustainable development.”

8 In addition to the ministries and their local representatives, including the relevant departments of autonomous public corporations, concession services and local authorities under the control of the Ministry of the Interior, the Higher Council of Water and Climate provides a coordination platform at the national level; on the operational level, this means that actions taken by several different bodies converge to meet the goal of providing access to water and sanitation.
• On the first level is the local authority or local authority association (owner of the infrastructure with the power to choose management mechanisms for water and sanitation services).
• ONEE [Office National de Electricité et de l'Eau Potable] (in urban areas and surrounding built-up areas and for the Rural Water Supply Program – PAGER).
• The Basin Agency.
• Public corporations under control of the Ministry of the Interior.
• Concession holders, national and international private operators.
• Associations (particularly associations of farm water users as part of PAGER).

9 Dahir 1-02-297 of October 3, 2002 promulgating Law 78-00 covering the Local Authority Charter (Official Bulletin of November 21, 2002).

CITIES: FIRST TO BENEFIT FROM THE GRADUAL SPREAD OF ACCESS TO WATER AND SANITATION

Drinking water is a priority in Morocco. All urban residents have access to an uninterrupted supply of drinking water in their homes.

A gradually increasing number of communities have been given access to this service. The state invests heavily in access to essential services for the poorest urban communities by using appropriate and innovative mechanisms.

Specific measures for the most disadvantaged were applied from the 1980s onward, with the launch of Operation Subsidized Connections, giving landlords or tenants the option to pay for their connections in monthly installments according to their means.

In the same spirit, in response to the exclusion of informal housing, in May 2005 King Mohamed VI launched the National Initiative for Human Development (INDH), one of the components in the strategy for upgrading every city, covering:

- domestic connections and sanitation (collection and treatment) in unstructured districts;
- *restructuring* and *rehousing* of communities living in informal housing districts.
- The INDH-Inmae project for greater Casablanca illustrates a further initiative taken by the state and the concession operator to combat urban poverty. The project aims to identify technical and financial solutions for access to domestic water, sanitation and electricity for 500,000 people.

The territorialized, banded pricing model means operators can apply an appropriate, mixed rate and use the first band as a social band.

A national sanitation plan, laying out a medium-term national strategy for wastewater collection and treatment, was adopted in 2006. The plan was designed to accelerate action in an area where the country had fallen behind: protection of water quality, reuse of water, and combating of wastewater discharges into the natural environment, which reached 600 cubic meters in 2005 and are projected to rise to 900 cubic meters in 2020.

Most African states, where almost all our migrants are from,¹⁰ have acknowledged that the right to water is a human right. However, they implement it in different ways, reflecting each country's specific options, financial resources and available water.

In this context, two additional factors underscore the importance of the water law:

- **potential insecurity:** the management of cross-border water resources is problematic in Africa. The continent is home to around 63 cross-border international drainage basins linked to states that cover 64% of the continent's surface area and account for 77% of its population and 93% of its surface freshwater. Only 19 of them are covered by a cross-border water agreement, while 15 of the agreements do not apply to all the states bordering the water resource in question;

- proven demand, particularly in June 2015 in the run-up to the Paris Climate Change Conference, when 162 INDCs¹⁰ noted that the water sector is a priority for African countries as part of efforts to adapt and monitor agriculture and health, sectors that are in direct interaction with water.

EFFECTIVE GOVERNANCE FOR SUCCESSFUL RESILIENCE

In the context of unequal distribution of water as illustrated by territorial disparities and heightened by climate change, governance is a crucial issue.

Awareness of the risks has grown, particularly during the Covid-19 pandemic. It validates the quest for a new equilibrium between economic activities, the natural environment and the human world. It could provide the basis for defining integrated policies to coordinate sector-specific public actions in the form of coherent, sustainable and possibly converging strategies and actions at the appropriate levels. Decisions can no longer be made only by pioneering scientists and development experts. At both the national and local levels, coordination, participation and harmonization as well as territorialized, decentralized, local action are now core concepts.

However, despite efforts to boost coordination, the observed impacts tend to be sector-specific, which is useful, but does not address the fact that water is a cross-cutting issue. If we wish to analyze it through the lens of climate change, we can only do so by adopting a comprehensive, cross-sector approach designed to re-embed the economy in the social order (sustainable development and social responsibility).

Initially tackled with a largely technical approach, the complex reality of this vital resource has gradually been taken into consideration. But what about implementation? We need to identify new modes of governance. The concept of water as "everyone's business" needs all development actors to get involved and take on responsibilities. We are switching from centralized action based on a unilateral act to a new type of response marked by the arrival of new actors: civil society and the private sector as well as the informal sector, which offers local culture and expertise.

Water calls on us to engage with different timescales in a difficult, challenging task that encompasses:

- looking to the past to learn lessons from it rather than indulging in nostalgia;
- tackling the complexity of reality, the here and now, with water recognized as key to sustainable development;
- taking account of sustainability in planning for the future and the world we want to leave our children and grandchildren;
- sharing experiences and conclusions.

¹⁰ 161 countries and the European Union out of 197 parties concerned by the negotiations.
- The acronym "INDC" stands for "Intended Nationally Determined Contribution" and refers to the contributions proposed by the parties ahead of the Paris 2015 Climate Change Conference, which took place from November 30 to December 11, 2015. It is a new type of instrument under the United Nations Framework Convention on Climate Change (UNFCCC), used by states to present, prior to the conference, national plans to combat climate change.

It will become increasingly important to tackle the issue of water not only in terms of equitable access, but also of risk management – arising from factors including the climate emergency – to avoid jeopardizing the achievement of the Sustainable Development Goals that Morocco has committed to, fully and resolutely.

A host of new questions remain to be answered: what form of value-added, which systems for assessing performance, the need for a results and accountability approach, regulation and promotion mechanisms at the national level, improving tools and roll-out in the field, certification and evaluation systems, etc. And then there are the issues that could block the process!

Strengthening the relationship between the research and action world and the decision-making world would offer tools for social water management, now recognized as key to technical and financial water management.

In concrete terms, this requires an interdisciplinary response to complex problems, each discipline interacting with the other, on a regulatory basis or by establishing dialogue

between science and the disciplines covered by human and social sciences.

Continuing to translate an equilibrium between economic activities, the natural environment and the human world into concrete actions is necessary to defining integrated policies which coordinate sector-specific public actions in order to operationalize coherent, contextualized, sustainable actions at the appropriate levels. What we need are the mechanisms of a circular economy.

In short, performance, ethics and the legal framework have to be encompassed.

The Coalition Marocaine pour l'Eau (COALMA), a non-profit organization, is working to meet these challenges. It is made up of representatives of the full array of stakeholders from the public and private sectors. It provides a space for sharing, discussing and suggesting experiences and ideas with the goal of conserving Morocco's water resources in the long term and developing Moroccan expertise.¹¹

¹¹ See www.coalma.ma

Water access and governance: the Veolia experience in Morocco

SUBSIDIZED CONNECTIONS TO ENSURE WIDESPREAD WATER ACCESS: REPORT ON THE AMENDIS (VEOLIA) EXPERIENCE IN TANGIER AND TÊTOUAN

As a part of the Initiative for Human Development (INDH) introduced by the Kingdom of Morocco, the program to ensure widespread access to water and wastewater services consists of creating the right conditions for low-income households in under-equipped districts to access essential drinking water and sanitation services by offering them payment facilities.

Amendis, the Veolia Morocco subsidiary in charge of water and electricity distribution as well as wastewater collection and treatment in Tangier, Tétouan, Mdiq, Fnideq and Asilah, bases its commitment to ensuring access to its services on two actions:

- studying and rolling out a program to provide under-equipped districts with water and sanitation services;
- designing and managing a subsidized connections program to provide low-income households with the financial conditions needed to connect to the networks.

In Tangier, the programs were formalized with two agreements signed by Amendis with its partners in the presence of His Majesty King Mohammed VI in 2006, then again in 2013 as part of the urban renovation project for greater Tangier.

Currently 149 districts and douars, spread across eight areas covered by Tangier delegated water management, are already equipped, adding up to 58,767 plots and 293,835 residents connected.

In Tétouan, Amendis has taken action as part of an urban and economic redevelopment program with a broader environmental approach. Between 2014 and 2018, this consisted of:

- combating pollution;
- providing water and sanitation services to disadvantaged districts;
- renewing and reinforcing water and sanitation networks, particularly in the historic center;
- combating flooding.

Six areas were equipped, with close to 63,150 residents benefiting from subsidized connections.

These subsidized connection programs owe their success to the use of mobile agencies (buses fitted out as agencies) providing a vital local service, and to the provision of a secure supply of drinking water. Eliminating wastewater discharge on roads and in nature also helps to improve sanitation conditions and the lives of people in the two cities.



© Redal

REMOTE MANAGEMENT FOR WATER RESOURCE PROTECTION: THE HUBGRADE PLATFORM OPERATED BY REDAL (VEOLIA) IN RABAT-SALÉ

The Kingdom of Morocco is one of the African continent's main actors in the fields of connectivity, telecoms, internet access and digital uses in general. Given this context, Veolia Morocco has made digital central to its strategy and solutions. In December 2019 in Rabat, its Redal subsidiary, in charge of managing water distribution and wastewater and electricity services in Rabat, Salé, Témara and Skhirate, opened its first Hubgrade hypervision center dedicated to operational performance.

The center is used for remote management of installations, equipment and infrastructure for Redal's activities in Morocco. Wastewater pre-treatment and treatment plants are concerned, but also water source stations, reservoirs, and water, electricity and wastewater networks.

For the water component, the center has a dashboard for monitoring operations and performance for water infrastructure (treatment plants, reservoirs, pumping stations, boreholes, etc.) as well as most of the wastewater system (including lifting and pumping stations, wastewater pre-treatment and treatment plants, etc.).

Operational indicators are generated automatically so that decisions can be taken quickly.

The center also has a system for pre-locating leaks with equipment installed in the water supply network that "listens" to pipes at night.

As repair teams use geolocation, operations are assigned and undertaken with maximum speed, thus limiting the volume of water lost. Although it is difficult to prevent leaks, it is critical to prevent them from flowing for too long.

The center's data collection capacities provide a concrete solution to the constraints caused by COVID-19. Veolia Morocco has therefore been able to adapt, protect its employees and continue with its task of delivering daily services that are even more essential during a crisis.

New digital solutions will soon make it possible to integrate several data sources. It will then be easier to detect errors inherent in infrastructure, including to help water source protection.

AFRICAN SMART CITIES IN 2030

Sénamé Koffi Agbodjinou

Architect and anthropologist, founder of the HubCité project



Working session at WoeLab - ©WoeLabs

Sénamé Koffi Agbodjinou is an architect and anthropologist who graduated from the Paris-La Villette College of Architecture and the School for Advanced Studies in Social Sciences in Paris. In 2010, he set up a research platform, *L'Africaine d'Architecture*, as a way to develop his neo-vernacular smart city concept. His HubCité project is a network of spaces promoting technological innovations (WoeLabs) that help local people take back ownership of their neighborhoods and design their own solutions. The project opened in Lomé, Togo, in 2012, bringing the concept to life. Sénamé Koffi Agbodjinou has been a fellow of the Ashoka network of social entrepreneurs since 2016.

Rejecting Western smart cities, which he feels are too top-down and remote from people's real needs, Sénamé Koffi Agbodjinou is a champion of the neo-vernacular African city. This alternative vision of the smart city, inspired by traditional societies and the organic ways they work through peer-to-peer exchanges at the village level, proposes a city that is horizontal and distributed. A city designed for and by residents at the local level making free use of new technologies as they see fit. A real-life application of this urban utopia can be found in Lomé where the HubCité project applies the principles of the neo-vernacular African city at the neighborhood level. HubCité exists to help people participate in how their city is designed and operated thanks to a network of technology innovation spaces, WoeLabs, that are dedicated to ultra-local urban projects. Each space serves a given area and supplies, on site, the resources that city-dwellers need to develop solutions that respond to their real needs, including waste collection, energy and 3D printing.

You advocate the concept of a neo-vernacular African city rather than a smart city modeled on the approach used in the West. Can you tell us more about this concept?

Sénamé Koffi Agbodjinou: The concept of the neo-vernacular African city that I have developed is based on a simple proposition: allow residents to design and construct their city themselves. This involves delegating some of the planners' and policy-makers' prerogatives to the people who actually bring the city to life. In reality, this is what mostly already happens in modern-day Africa, where there are many spontaneous urban areas that are sometimes more dynamic than officially regulated and planned urban areas. The aim is to delegate this planning power to residents, to officially incorporate this spontaneous urbanism and provide it with the means to become more professional and ensure that the movement does not fall into a sort of anarchy.

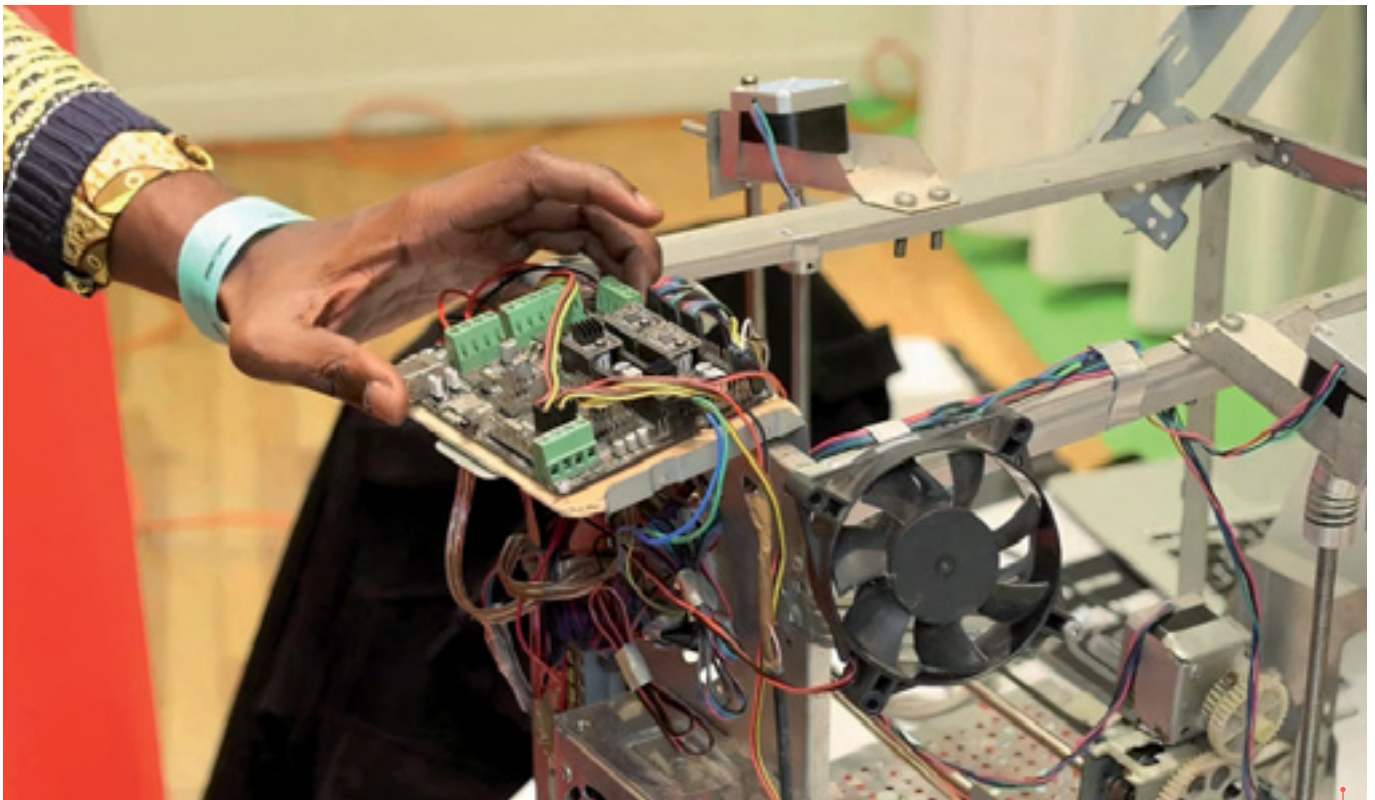
At the moment, smart cities do not exploit all the potential of new technologies because they do not put them in residents' hands to ensure that they truly serve local people's needs. Smart cities are primarily designed by and for companies from Silicon Valley. The smart city concept that I advocate is an alternative vision that seeks to genuinely make tech available to residents, to give them the freedom to think up initiatives to create their own city. The idea is to devise a far more distributed system, along the lines of Africa's traditional societies and villages.

How can African villages be an inspiration for building smart cities in Africa?

SKA: When I talk about the model of the African village, it's actually a form of shorthand. I'm referencing so-called primitive traditional societies. These societies were made up of members whose aim was to find common solutions to their common problems. The group was already a form of technology, probably the first of all and precursor to the augmented human. These group-based societies developed complex systems and organic social structures that made it possible for the group to function.

But these so-called primitive societies struggled as towns and cities grew larger. The organic traditional systems, based on peer-to-peer relationships and exchanges and relying on oral accounting systems ("I know what I owe you and what I must give to you"), were not designed to regulate group life on the scale of a city. Monopolies and governing institutions emerged to administer societies that were now operating on a larger scale. But these governing mechanisms, which made sense during the period when cities were expanding, are now often obsolete because the technologies available to us today make large-scale organic societies possible.

If we chose to use new technologies to support systems that are more distributed, using traditional societies as a model, I'm convinced they would be far more ethically sound and of genuine use to the city and society. A lot of people involved with open source movements have come to similar conclusions, based on what is known as



Wafate, a 3D printer made from computer waste at WoeLab - ©WoeLabs



Collecting plastic waste - ©Woelabs

the archipelago model: several communities within a city organize locally and autonomously using their own resources along with cross-cutting technologies so they can connect to each other and develop in a coherent manner. By combining these new technologies with traditional organic systems, we can invent new societies and new ways to make cities livable.

How can this form of smart city be built on the ground?

SKA: The HubCité project we've developed is the concrete, operational expression of the desire to construct a neo-vernacular African smart city. It exists to give residents the resources to build their city themselves thanks to a network of technology innovation spaces, WoeLabs, that are dedicated to ultra-local urban projects. These spaces are open to local residents. They serve as incubators for local people and provide them with resources to help them design and produce technologies that tackle the real local problems they have to deal with. Since HubCité started in 2012, we have opened two 650-square-meter WoeLabs, which were actually Africa's very first fab labs.

WoeLabs serve as incubators for local people and provide them with resources to help them design and produce technologies that tackle the real local problems they have to deal with

To make sure that each space is as relevant and effective as possible, we thought up a dense network of labs operating every one or two kilometers. The idea is that each lab incubates and develops services exclusively for its local area, such as managing waste collection within a radius of one kilometer, producing energy for use within the same radius, and so on. And as more of these labs are created across a territory, this territory will become "smart" by definition: with labs that produce smart citizens, and people with the tools to develop solutions that suit their environment.

A large number of fab labs promoting technological innovation have emerged in Africa in recent years. HubCité is a pioneer of this movement: WoeLab is older than 90% of the labs that have since sprung up. Two of the principles underpinning the WoeLabs are also very innovative. First, they are multi-disciplinary spaces, not simply places where people go to do a spot of DIY. They need to support projects created on site from the initial idea through to development and any scaling up. They should also offer social support, training, and so on. Everything is designed to help people using the spaces to achieve their full potential. They are close in spirit to the "third places" that have started to appear in recent years. And the spaces must be genuinely of service to the city, and help to fabricate solutions designed for it. Every project has to be conceived with the goal of solving local urban problems.

Our project did not set out to create a lab because of the technology, but to serve a territory and create a unique citizen community.

What solutions for access to services are people at the WoeLabs in Lomé devising?

SKA: The WoeLabs model is meant to be very focused on essential services. Every lab is created to be both a waste bank for its local area and a source of energy producing enough for everything within its scope of activity. In practical terms, we've managed to set up a plastic waste bank at both the labs in Lomé. HubCitizens who live in the area around the lab can visit and sign up and we'll then collect plastic waste from their homes. We issue them with a bin, low tech right now but we hope to use connected bins eventually. People put their plastic waste in the bin and when it's full they phone the lab and a member can collect it the same day because the labs cover only a small radius. The waste is then sorted and sold to specialist operators for recovery. Every bin a HubCitizen fills earns them points that can be used on the HubCité platform. These points are a gateway to an alternative economy, where wealth comes from the services you offer the city: sorting its waste, helping in city vegetable gardens, offering free training in the labs, and so on. All these services earn you points, which you then trade with other HubCitizens.

What do you think the African city will look like a decade from now?

SKA: If we believe the demographic projections from leading international organizations, the future of the city is African: in 20 years' time, the five largest megacities will all be in Africa. My belief is that if these new forms of cities, these metropolized regions, continue to follow the current dynamic and its fascination with the Western urban model, then they will considerably and dramatically hasten the Anthropocene.

But if African societies can create new ways to live in the urban sphere, refusing to allow social structures to be swept away by technology and reappropriating the organic traditional systems they have abandoned, if they manage to reverse the trend and use technology to foster social structures, then Africa will stand as a beacon for the rest of humanity.

What direction will the cities of Africa take? It's hard to predict because Africa's city-dwellers are paradoxical: on the one hand they're massively eager consumers of all that's new, which sometimes stops them from questioning the current development model, but they're also still very close to the land and they cultivate very strong social ties. It's this last point that convinces me that another urban model is possible for Africa.

2. HIGH-POTENTIAL INNOVATIONS FOR A FAST-CHANGING CONTINENT



Africa, particularly the sub-Saharan regions, has long been handicapped by the prevalence of simplistic images, rooted either in afro-pessimism or over-valuing the leapfrog effect to transform its development gap into new comparative advantages. Countless reports have highlighted this new narrative, depicting an Africa that is digital and innovative, mobile money being an iconic example of this powerful new movement.

However, there is less focus on the vision of development, urban in particular, that these innovations are supposed to help bring about. And modern Africa's aspirations for its cities are different, not to say divergent. Edgar Pieterse, at the University of Cape Town, believes that urban development could follow at least four separate scenarios:

- The status quo scenario: a situation unchanged from today's position;
- The green status quo scenario: a more environmentally friendly variant without any fundamental spatial changes;
- The smart city scenario, with blossoming new technologies and major digital businesses but no answers to financial accessibility issues;
- The adaptive city scenario, where technological innovations are adopted but remain rooted in residents' existing practices and habits.

The innovations presented in this issue all fall within the fourth scenario, using technological innovation to address the needs and realities of the majority of its inhabitants.

First come innovations in terms of products and services that need to reflect the particularities of the situation in Africa. Actors across the continent therefore seek to reconcile a frugal approach to innovation – unlike many businesses that equate innovation with greater sophistication – while doing whatever it takes to avoid a paternalistic mindset that seeks to offer degraded services to the least well-off. This idea of “good enough innovation” makes it possible to achieve a balance between these two competing visions, offering products and services that are affordable as well as being aspirational. In sanitation, simplified toilet solutions have been developed in recent years, along the lines of the container-based solutions (CBS) developed by Sanergy, presented in this issue by Louise Couder and Sheila Kibuthu. Such innovations very frequently require us to think outside the box, dreaming up totally new ways of doing things. This is the mindset embraced by Veolia in Africa as described by Christophe Maquet.

Then there are innovations in the economic models, in a context where users are unable to pay the full cost of services, which involve equalization systems, either between services or between users. Recourse to alternative financing models can even involve the cost of a product

or service falling entirely on a third party. The question of equalization raises that of governance, because it requires alignment between stakeholders on the issue of how costs are apportioned. Innovation is therefore also a matter of institutional practices and governance. The role of public actors remains fundamental and technological innovation can never be “the panacea for urban planning”, in Guillaume Josse's phrase. Interfaces between public policies and market mechanisms are key to the development of complementary solutions. For off-grid energy, Sylvie Jaglin and Emmanuelle Guillou explain how institutional uncertainty has triggered the rise of alternative market solutions. All too often, regulations “do not keep pace with these evolutions, making it difficult to create smart hybrid solutions.”

Clearly, innovation also involves reinventing collaborations between the formal and informal sectors in countries where numerous services, due to a lack of satisfactory alternatives, are provided by the informal economy. New digital businesses are trying to bridge the gap between supply and demand together via platforms that put waste generators and collectors in touch with each other. Jeffrey Provencal explores ideas for collaborations in this field. Technology can also be a formidable lever for building new models in a continent with ever-growing cellphone penetration rates. The rise of pay-as-you-go technologies makes it possible to pay for services at levels affordable by each individual household. Sam Drabble outlines several trials using smart water meters.

Lastly, innovation requires a resetting of relationships with users or consumers. This entails incorporating their needs, perhaps even co-creating solutions. The work led by Slum Dwellers International highlights the importance of involving the urban poor in mapping their neighborhoods and designing solutions for access to energy.

Mathilde Martin-Moreau
David Ménascé
Archipel&Co,
Issue coordinators

VOICING THE URBAN POOR: EXPERIENCE FROM AN ENERGY JUSTICE PROGRAM FOR AND BY SLUM DWELLERS

David Sheridan
Slum Dwellers International
Energy Justice Programme (EJP)
coordinator

Mwaura Njogu
Renewable Energy Engineering
Consultant

Andrew Maki
Co-director of Justice &
Empowerment Initiatives (JEI)
Frederick Agyemang
Project coordination EJP Ghana



Member of a Data Collection Team, working on settlement profiling in South Africa ©KYC TV

David Sheridan coordinates the Energy Justice Programme from the secretariat of Slum Dwellers International (SDI), a network of community-based organizations of the urban poor in 32 countries.

Mwaura Njogu is the sustainable energy planning lead energy engineer supporting Akiba Mashinani Trust and Muungano Wa Wanavijiji in the development of Local Integrated Development Plans for informal settlements in Nairobi, Kenya.

Andrew Maki is co-director of Justice & Empowerment Initiatives (JEI) the support NGO to the Nigerian and Benin slum dweller federations.

Frederick Agyemang is a socio-technical and development practitioner working with the Ghana Alliance to give voice, capacitate and improve livelihoods of the urban poor.

SDI emerged in the mid-90's through peer-to-peer networking of organised slum dweller movements. Today this international network spans 32 countries where grass roots community organisations are supported by professional support NGOs in the building of social movements, transforming urban environments, and securing a more inclusive and resilient future for the world's urban poor. SDI's mission is to build the voice and agency of slum dweller communities, with a special focus on the role of women, in order to achieve inclusive cities in which the urban poor are to be at the centre of strategies and decision-making for equitable urban development.

SDI has a commitment to project typologies that produce learning at scale around clean energy access as part of its informal settlement upgrading agenda. Since 2014 SDI has been involved in the field of access to energy particularly in Africa, India, and the Philippines where the SDI Energy Justice Programme leverages community-led collection of disaggregated energy access data (using the Know Your City tools), community empowerment programs, and pro-poor access models in contribution to energy access goals. In the face of growing needs of access to many essential services in slums, SDIs model provides bottom-up, innovative, and adaptable methodological options for catalysing pro-poor change at settlement, city, national, and global levels.

INTRODUCTION

The number of slum dwellers in developing countries increased from 689 million in 1990 to 1 billion in 2018.¹ In some cities in emerging countries, slum residents make up for more than half of the population and often do not have adequate shelter, clean water and sanitation, access to clean and safe energy, education, or healthcare.

Many governments and international organisations have tried to curb the growth of slums with a limited understanding of underlying drivers of informality, or an appreciation for the vital role their residents play in the functioning of the wider city. The perception of slums being transitory or marginal places deserving of limited attention persists. Generally, this leads to evictions, limited provision of basic services, lack of dialogue between governments and residents of slums, and ill-conceived top-down approaches to urban development.

Since its creation in 1996, SDI has amplified the voice of the urban poor by networking national social movements at a global scale. Communities of slum dwellers organized in local savings groups at settlement level, built into national Federations, from where they are linked to the global network. Federations are trained, equipped in the use of settlement profiling tools and consequently are able to

¹ UN statistics on SDG 11, dated from 2018.

take large steps towards “existence on the map”. Data and data collection processes lie at the core of this approach. In 2014, SDI launched the Know Your City (KYC) campaign. KYC provides a data collection process that empowers communities to co-create solutions. KYC has been a real catalyst to shift to a ‘bottom-up’ approach, paving the way for collaborative planning and action, and participatory investment in access to essential services. In the field of basic energy access, the Energy Justice Programme has been leveraging this data collection process to develop new pro-poor models for accessing clean and safe energy.

KNOW YOUR CITY: SDI’S ‘WEAPON OF MASS CO-CREATION’

SDI, A GLOBAL CONSTITUENCY FOR THE URBAN POOR

During the 1980s and the 1990s, urban poor national and local associations from countries across Asia, Africa and Latin America had multiple exchanges, which revealed the critical value of a network of community-based organizations driven by the poor themselves. Slum Dwellers International (SDI) was officially launched in 1996 to draw attention to the need for a social development approach fully considering the lived experiences of slum dwellers and to gather local and national organisations at a global scale. In 2020, SDI is a transnational social movement driven by over one million grassroots urban poor across 32 countries in Africa, Asia, and Latin America. The overall intended impact of SDI’s work is the creation of inclusive and resilient cities where the lives of the urban poor are substantially improved, and development agendas are shifting to be more inclusive and pro-poor, and ultimately more resilient and sustainable. In short, it empowers the urban poor to change their own lives and the shape of their cities by enabling slum dwellers to engage with local and national government as partners in development rather than simple passive beneficiaries. Radically different from the standard development organization approach, SDI is led and governed by leaders of national slum dweller federations themselves.

Slum Dwellers International (SDI) believes that the lack of disaggregated and precise data about tenure security; clean water and sanitation; clean safe and affordable energy; housing; education, or healthcare perpetuates anti-poor urban development. It prevents slum dwellers from showing evidence of their experiences, from collectively

understanding the challenges they are facing and from expounding these in a comprehensive way.

Launched in 2014, KYC emerged from the historical practice fostered by SDI of slum dwellers collecting data about their everyday lives and the spaces they reside in. It seeks to refine and standardise data collection processes across the SDI network in order to enhance the impact of community generated data. KYC took the shape of a joint campaign between SDI-affiliated federations of the urban poor and the United Cities and Local Governments of Africa (UCLG-Africa), with active support from Cities Alliance, of which SDI and UCLG-Africa are prominent members.

Concretely, slum dwellers collect data, which is shared by their federation with KYC to be certified and made public in an aggregated form. Data can relate to the infrastructure level, access to health, access to energy, education, aspirations... Once data has been captured by community data teams (CDTs), i.e. trained local slum dwellers, a process of validation takes place, where data is presented back to the community. This validation process not only allows a grassroots peer review process but seeks to achieve a broader self-realisation impact on the slum community. Importantly, the information is housed in a data system shared by city governments and slum dwellers. At the close of 2019, SDI-affiliated slum dweller organizations had profiled 224 cities in Africa and Asia, covering 7,712 settlements.

KYC challenges the “smart cities” concept, which tends to place a major emphasis on the use of high-tech and big data to guide choices in the planning and management of cities. Whereas big data inarguably unlocks insights resulting in increases in efficiency in the delivery of services, KYC presents data that is co-created and co-owned with users as a key enabler of transformative development possibilities and outcomes, built on relationships of trust between slum dwellers, city authorities and the private sector increasingly. KYC offers a strategy for harnessing data that is deeply rooted in local knowledge and context, to guide decisions to make cities safe, secure, liveable, and attractive to all.

Through KYC, SDI seeks to articulate settlement, city, and global levers to increase and anchor impact in the long term, while challenging on each level the traditional approach toward access to essential services in slums. From this process, 3 pathways to impact with specific goals and means, and essential synergies have crystallized:

IMPACT AT THE SETTLEMENT LEVEL

At a settlement level, savings groups are the building blocks of SDI federations and drive campaigns towards improved access to essential services. At their most basic level, savings are key to cope with unexpected shocks (medical bills, school...). However, as the Liberian SDI alliance reported, “federations throughout the network know that savings groups do more than collect money – they collect people and build a critical mass. When the savings



Data collection team in Nyanga, Capetown, South Africa ©KYC TV

groups are networked, federations are born.” In Malawi, 83 federation members were able to construct new toilets using their savings, while others used their savings to leverage credit from the Mchenga Fund to build theirs.

In each settlement, SDI’s approach also brings to light and creates space for new leaders, challenging power imbalances between genders, ethnic groups. The Nigerian SDI alliance reported that while “traditional leadership in informal settlements tends to be male-dominated and undemocratic, often not putting the communities’ interest first”, community-led data collection process enables other stakeholders to “emerge as agents of change”: this is especially true for women and youth. For instance, savings groups are mainly led by women who get together and start talking about their own daily struggles: school, food, energy, sanitation². In the end, these processes create spaces and build the agency and ownership of the urban poor over local urban development agendas – ultimately upending traditional power structures and putting the urban poor at the helm of community upgrading and development.

IMPACT AT THE CITY LEVEL

Filling the knowledge gap is the first essential step towards an informed and balanced dialogue between slum and informal settlement communities and city governments. In the absence of disaggregated data, decision makers

continue to use urban averages that perpetuate myths and flawed assumptions, especially regarding access to essential services. At a city level, KYC fills this gap by providing data on informal settlements and has made possible the re-examination of these assumptions.

KYC has identified and debunked 3 flawed assumptions:

- “Informal settlements are temporary way stations for the urban poor on the path to modernity and prosperity.”³ In fact, slums are permanent poverty traps. Many of the world’s urban poor population in low-income countries reside in informal settlements for more than one generation. Indeed this is a core driver of population growth in cities in the so called global south.
- “Slum dwellers benefit from better overall health conditions in urban areas.” In fact, the “urban health premium”, i.e. better health conditions in cities than in rural areas, is a myth. In some African cities like Nairobi and Dar es Salaam, for which data is available, health outcomes (infant and child mortality rates...) among low-income urban dwellers are far worse than among low-income rural dwellers.
- “The conditions of the urban poor can be improved without their involvement in planning processes.” Urban planning and implementation cannot be built without consideration of people’s incomes, needs, and preferences, and the direct involvement of the urban poor themselves.

² SDI also hosts the KYC TV program – a complementary video documentation program focused on life in informal settlements. KYC TV also created a space for personal expression and creativity for the slum dweller youth.

³ *Know Your City : Slum Dwellers Counts*. SDI report. Cape Town, 2018.

KYC is changing the mind-set of urban planners and creating the conditions for dialogue on concrete slum upgrading projects. In Cape Town, in partnership with the Provincial Government, the SDI federation purchased a 27.73 ha piece of land with the intent to build homes in an infrastructure and upgrading project: Vusi Nsuntsha Development. There, they planned an area-wide, mixed-use development and resilient neighbourhood that will house 800 families. Vusi will also include residents from Cape Town's most dense settlement Kosovo. Since this experience, co-creation with slum dwellers is now rooted in the urban development plan of Cape Town.

IMPACT AT THE GLOBAL LEVEL

At a global level, KYC processes and data challenge national governments, international intergovernmental bodies, and multilateral development agencies, other international networks, among others, to engage with the realities of urban poverty, which is a condition for greater global investment in pro-poor urban development and access to essential services. SDI participates in global working groups (UN, etc.) to influence policy. SDI also supports regional hubs of national slum dweller federations and peer-to-peer exchange between federations and their partners. Moreover, SDI manages the Urban Poor Fund International (UPFI) it has created to finance its pro-poor upgrading policy. It provides capital to member National Urban Poor Funds (UPFN), so that they can in turn provide funds to savings collectives undertaking important urban improvement and housing projects.

How can we “leave no one behind” if there are hundreds of millions of urban dwellers whose needs are undocumented, whose voices are unheard, and whose capacities are ignored?

SDI'S ENERGY JUSTICE PROGRAMME

The Energy Justice Program (EJP) is a demonstrative case study of SDI's action to improve the access to essential services in slums. The SDI Energy Justice Programme consists in using all the SDI tools, including KYC, to generate grassroots and tailor-made solutions to energy access in slums. Indeed, energy is a key condition to develop essential services in these neighbourhoods: safety depends on streetlights, communication depends on charging one's phone, etc. Today, the SDI Energy Justice Programme has active projects in 12 countries (Ghana, Nigeria, Uganda, Kenya, Tanzania, Zambia, Malawi, Zimbabwe, South Africa, Namibia, India, and the Philippines) and has enabled affiliate federations to provide improved energy access to approximately 25,000 distinct households with the total number of beneficiaries numbering in the region of 100,000.

THE CHALLENGING ISSUE OF ACCESS TO ENERGY IN SLUMS

The lack of access to sustainable energy services and technologies is a major impediment to the development

of slums. And this issue has faced many obstacles and challenges for decades. The growth of informal settlements' population often outpaces the financial and practical ability of individual governments to connect these communities to centralised energy systems, and to keep them connected. Moreover, the few important projects they might invest in are often flawed, especially regarding their basic assumptions. For instance, many governments consider that grid connection is the only way to provide affordable energy access in informal settlements. In fact, financial and practical barriers to extending the grid can often leave urban communities un-serviced for decades, when alternatives such as off-grid solar technologies are readily available and increasingly affordable. In the end, the failures of either misappropriated government programmes or exclusive corporate initiatives require new approaches toward the development of the energy infrastructure in slums.

THE FULL USE OF THE SDI TOOLKIT

SDI's core rituals of community-led settlement profiling, women-led savings groups, and peer-to-peer exchanges represent an opportunity for communities to develop innovative solutions to their critical service delivery gaps. The EJP sets out to leverage these assets to develop scalable energy access projects and integrate these into wider settlement upgrading programmes.

The settlement-based community data collection, enumeration & mapping process of KYC is the most important of these tools. In Lagos (Nigeria), Justice & Empowerment Initiatives, a local NGO supporting the local SDI federation, applied the KYC methodology, building an exhaustive survey in close consultation with C40, the Ministry of Environment, and the Lagos Bureau of Statistics (LBS), along with the technical advisors from the University of Lagos, Hamilton College, and the Massachusetts Institute of Technology (MIT). The survey questionnaire was translated into various local languages and tested several times in the field. Enumerators were trained in informed consent and data security, to verify responses using control questions, to conduct a physical inventory in the household, etc. Once the operation was done, participants took the resulting reports back to the surveyed household to share back and verify the data and discuss the first conclusions of the survey. The survey findings and recommendations, as well as the disaggregated data, were then shared with the Lagos State Government as a basis for energy upgrading partnership. Finally, this survey gave SDI in Nigeria much stronger bargaining power in its arm wrestling with an electricity distribution company that had decided to hike the electricity fees up in slums. The company stepped back, which shows how SDI local federations can shift power balances between slum residents and private-owned companies or other stakeholders.

NEGOTIATION AND CO-CREATION WITH ALL THE STAKEHOLDERS

Data collection is a means and not an end: data products produced as outputs from the Energy Justice Programme are able to be used to influence and negotiate with the key stakeholders. Although SDI helps the slum dwellers to initiate projects and solutions by themselves, their realization requires long-term work with the other stakeholders, particularly when faced with large scale area upgrading including access to energy. The case of Mukuru (Kenya), arguably Nairobi's largest slum, is the epitome of this multi-partner and holistic approach.

In 2017, the longstanding close work of SDI's Kenyan affiliate with the Nairobi City County Government (NCCG) resulted in the official designation of the Mukuru informal settlements as a Special Planning Area (SPA). The mandate of the Mukuru SPA project is the development of the area's Local Integrated Development Plan – with a focus on access to essential services – in the framework of the Nairobi Integrated Urban Development Master Plan (NIUPLAN) for 2014-2030.

This landmark breakthrough has subsequently demonstrated the application of community mobilisation methodologies and participatory approaches to slum redevelopment planning and implementation. In collaboration with NCCG Kenya's SDI affiliate has coordinated the work of developing a comprehensive spatial plan for the redevelopment of Mukuru. This work was multi-sectoral in nature and included inputs from sector partners including those specialising in housing, water, sanitation, energy, health, etc.

By leveraging the Energy Justice Programmes experience and combining these with the principles and methodologies of community led data collection (KYC), SDI took a leading role in contributing to evidence-based recommendations for energy access technologies, delivery models, and policy and planning alternatives for integration into Mukuru's spatial plan. What is notable here is integration of local community members in the co-creation of fit for purpose energy access recommendations, as well as how the existing social infrastructure arising from longstanding community mobilisation proved ground breaking in respect to its ability to facilitate a truly participatory process aimed at contributing to the acceptability and sustainability of any given energy access solution. Community Data Teams (CDTs) were involved in the collection of energy demand capacity data at a household level, enabled access to insight into an informal energy access economy fraught with complexity and were able to mobilise large scale community data verification processes held throughout the slum.

This long-term project will also involve international agencies, such as The World Bank, Nairobi Metropolitan Services, private and public companies, like the national electric utility company Kenya Power and Lighting Company (KPLC), which will play a key role in the upgrading of the

energy infrastructure. This high level of institutionalized cooperation is owed to the Kenyan statutory and regulatory framework, which is one of the most advanced in the region. Hence, the SDI Energy Justice Programme has a ratchet effect: evidence to influence decision makers, cooperation with them (public and private, local and international), which can result in the adoption of a legal frameworks – like the Mukuru SPA – and guaranteeing this institutionalized co-creation process in the long-term.

KEY LEARNINGS FROM THE ENERGY JUSTICE PROGRAMME

Since the inception of EJP, SDI's teams have identified some key learnings in terms of project design and impacts.

THERE IS NO "ONE SIZE FITS ALL" PROJECT

SDI does not propose a unique solution but a strong methodology to legitimize each energy solution emerging from and required by a specific context. In Dzivarasekwa, (Zimbabwe) and Longlands (South Africa), the solution was the equipment of slum dweller households with solar home systems (SHS) the latter seeking to leverage a government energy subsidy for the poorest via a private sector enterprise. In Mukuru (Kenya), a delegated service delivery model for lighting and pay-per-use energy solutions for cooking are being implemented. At last, in the cities of Kampala and Jinja (Uganda), the emphasis was put on solar streetlights.

SAVINGS GROUPS TO FUND OFF-GRID SOLAR HOME SYSTEMS

The SDI savings groups have been particularly adapted to the improvement of energy access in African slums. In Dzivarasekwa (Zimbabwe), off-grid solar home systems



Delivery of solar lighting solutions in Mbale, Uganda ©KYC TV

(SHS) were provided to households on a group savings and loan basis. The Gungano Urban Poor Fund offered two different SHS options, with no interest charged on the loans and no overall profit margin. After passing a vetting process, a household could get a loan if it was a member of one of the community savings groups (minimum 20 members). The loan scheme was based on a 'revolving fund' principle; loan repayments returned to the fund to provide new loans for new participants. 95% of all due payments were made monthly, so loan rescheduling or repossessions were not required. This example shows how the savings groups can be a very practical financing solution, in the field of the Energy Justice Programme. This model is easily replicable and adaptable; and SDI is working on it.

We know our communities, and our community members know what they have and what they don't have. This is the best thing about Know Your City

TRAINING OF COMMUNITY MEMBERS

Also, central to the implementation plan was the training of community members on all technical aspects of delivery. 15 trained community members were engaged as technicians to scope, install, repair, and maintain the solar systems, and to educate new users on how to use them, along with 3 mobilisers and 2 loan officers.

ONE SOLUTION, MULTIPLE IMPACTS: THE EXAMPLE OF SOLAR STREETLIGHTS IN UGANDA

In Uganda, the setting up of solar streetlights in Kampala and Jinja had a remarkable spill over effect. First, the installation of lighting on busy roads and junctions reduced car accidents, which eased traffic and helped address congestion and air pollution. Second, lighting the streets improved safety by reducing crime rates. This led to the appropriation of the public space during the night time by marginalized groups, especially women, who were the first victims of assaults. Third, this enhanced the night time economy. Business owners were able to trade for an additional five hours per day and have many more customers due to the streets being busy again. This could equate to approximately 4,000 more full time jobs in Kampala.⁴ In Jinja, the local co-production of solar-powered streetlights has also created skilled and technical jobs in the solar sector for a vulnerable young population living in slums. In the end, the combination of these positive shifts increased the property values, and consequently the attractiveness of the neighbourhood itself.

INTEGRATION OF DIVERSE DISTRIBUTION SYSTEMS

The transition to low-carbon energy systems is increasingly considered in the delivery of energy as basic service for urban-poor communities with recognition by the public and private sectors that communities must play an

instrumental role in the implementation and management of energy transitions even though progress has thus far been slow. By including communities to drive and co-create the opportunities of the energy transition, the adoption of new technologies may be accelerated, more inclusive policies may be developed, and capacity and skills built to support existing and new economic activities. Informal distributors are frequently entrepreneurs who live in informal settlements and draw customers and their workers from the same neighborhoods. Efforts to integrate these diverse distribution systems have been unsuccessful and often conflictual hence there is increasing interest in exploring new integrated supply modalities.

In Ghana the EJP is therefore exploring economically viable, environmentally sustainable and socio-technologically integrated forms of providing energy services, alternatives to grid-based electricity and the uptake of more efficient and healthier cooking fuels for households. Six communities in Accra participated in both quantitative and qualitative surveys, including Ashaiman, Agbogbloshie, Chorkor, James Town, Madina Zongo and Shukura.

CONCLUSION

In informal settlements, the lack of access to essential services has restrained for decades the economic and social development as well as the well-being of the slum dwellers. Across the continents, the paradox remains the same: their number keeps growing while their influence stagnates. SDI seeks to empower urban poor and secure their 'seat at the table' with mainstream actors such as city governments and international organizations. The SDI federations, either local or national, are today well-identified interlocutors invited to working groups. Know Your City and the savings groups demonstrated their impact and credibility through a multitude of solutions implemented in various backgrounds. In particular, the community-led collection of disaggregated data filled a major gap in the design and implementation of a pro-poor urban planning. SDI is targeting Latin America and Asia to spread and replicate this methodology born in Africa.

⁴ Gillard, R., Oates, L., Kasaija, P., Sudmant, A., Gouldson, A. 2019. Sustainable urban infrastructure for all: Lessons on solar-powered streetlights from Kampala and Jinja, Uganda. Coalition for Urban Transitions. London and Washington, DC.: <http://newclimateeconomy.net/content/cities-working-papers>.

PLANNING AND MANAGING AFRICA'S CITIES: WHAT PLACE FOR TECHNOLOGY INNOVATIONS?

Guillaume Josse
Project leader at Groupe Huit and
co-founder of the startup Wexity-Logiroad



Guillaume Josse is project leader at Groupe Huit, a consultancy specializing in the urbanization challenges facing cities in developing economies. He is co-founder of Wexity-Logiroad, a city data management platform for cities in developing economies. A geographer and urban planner, he has over 20 years' experience in urban development and supporting municipalities. He has led countless feasibility and urban planning studies, and has arranged financing for infrastructure in Sub-Saharan Africa, Asia, the Middle East and Latin America.

Urbanization in Africa is mostly inflicted and informal. The past 50 years have seen plans created for many cities of Sub-Saharan Africa, but with no convincing end results. One of the key explanations for this failure lies in the lack of available basic data about cities and their inhabitants. The data exist but are not managed or exploited. However, working from correct information is essential for properly managed urban planning. It makes it possible to build the land use registers, and tax systems based on them, that are needed for the operation and financing of urban systems. Advances in digital technologies offer new perspectives for urban planning in very-high-growth cities. They are an opportunity to do more for less: satellite images, photo-interpretation software, crowdsourcing and participative cartography are just some of the new tools available to city planners. This is the aim of Wexity-Logiroad, the first turnkey city data management software platform to suit the realities of cities in emerging economies and strengthen capacity in local institutions. But though offering new possibilities, new technologies cannot be thought a panacea for urban planning challenges, which remain fundamentally political and human as well as highly dependent on the state of public finances.

INTRODUCTION

The speed of urbanization in Africa is clear to see – all Africa's cities will have doubled or tripled in population within a generation. Twenty or so megacities are emerging on the continent, three of them absolute giants: Cairo, Lagos and Kinshasa. The spectacular spread of these capitals should not, however, mask the equally fast growth of Africa's secondary cities. Small and medium-size towns and cities across the continent are seeing the same rate of expansion, so the entire urban framework is in fact growing. An enormous amount of effort is needed to support and manage this urbanization. Two fundamentals sum up the origins of the problems facing Africa's cities and the deficiencies in terms of developing access to urban services: difficulties in managing a fast-growing territory; and difficulties in financing services, given that towns and cities in Africa run on budgets around 100 times lower than their counterparts in the north.

Land registers, with accurate and up-to-date management of land use, are essential for proper planning as they make it possible to identify all the plots that together make up the city. But land use is not controlled in Africa: structured neighborhoods sit alongside informal ones, flood-risk zones are built on, and so on. Technological tools alone will never be the sole determining factor in changing planning practices, because people and money are the keys. However, the innovative solutions now available for dealing with current challenges make it possible to provide more for less in the planning and management of African cities.

AFRICAN CITIES: INFLICTED URBANIZATION

UNPLANNED URBANIZATION AND DEFICIENT SHARED SERVICES

Without shared services there is no city. Pooling resources to make it possible to build large-scale infrastructure is at the origin of the first cities of antiquity. Hospitals, universities, networks for energy, water, information, public transportation and so on all require capital for their construction and operation. Providing this capital is the natural role of the local government authorities in place. The services determine the quality of the environment, public services, information and economic opportunities expected of a city.

But urbanization in Africa is currently neither controlled nor supported by the continent's municipalities. More and more people are moving to towns and cities, but these are not developing the urban functions that people and territories require. In some ways we have the city, but without the urban way of life that is expected of it. This is especially true of sanitation or waste processing systems, which are very far from available to all residents. Almost 700 million people, over half the continent's entire population, have no access to a sanitation system.¹

REASONS BEHIND THE URBAN PLANNING DEFICIENCIES

Three factors explain the lack of planning in African cities: absence of useable up-to-date information and data, inadequate land registry management, and lack of finance as a result of weak fiscal systems. These are inextricably linked, each strengthening the other: without information it is impossible to build a land registry system, and without a land registry it is impossible to collect the taxes needed to finance infrastructure and shared services.

(1) **Lack of information about the city and its inhabitants:** without access to simple data such as the number of residents or the state of existing buildings, success in public policy-making can only be very hit-and-miss. This information is essential to detecting people's needs, preventing risks and assessing costs. It could be said that Africa's cities are operating blind, such is the lack of basic data. In the Democratic Republic of the Congo, the last general census dates from 1984 and has been an ongoing saga for every subsequent government. Collecting the data isn't complicated, but it is expensive. It requires considerable technical and human resources to inventory, update and check an exhaustive database. In administrations that tend to be highly compartmentalized,

existing data are rarely digitized and shared between different municipal departments, let alone kept up to date.

(2) **Inadequate land management:** without basic information it is impossible to manage land use or a land registry. But land has always been the fuel for urban development, with land and taxation inextricably linked. The ancient cities of Babylon and Basra were forerunners, establishing land registries to settle disputes between citizens, regulate urban growth and raise taxes. With a land registry system, citizens have to pay local taxes, duties or, in certain cases, contributions in kind. The trade-off is that individuals benefit from the wealth of the collective enterprise in the form of shared services and infrastructure. This is true of all "developed" cities. But land use is not controlled in Africa, apart from in South Africa and the Maghreb. And even if rules do exist, urbanization is primarily informal. Land registries are usually out of date because of a lack of data and human and financial resources, meaning that cities are unable to set up efficient systems of taxation.

(3) **Lack of the means to implement planning choices:** as a direct consequence of the absence of land registry and land use management, most cities in Africa do not have the financial resources to implement long-term planning policies. Whereas French municipalities have budgets of three to four thousand euros per resident per year, the amount is a hundred times lower in Africa. Cotonou has around 18 euros per year per resident, Dakar 100 euros and Kinshasa just two or three euros. Setting up a tax system may be an expensive operation, but it is also the only area where the return on investment is tangible and quantifiable over the long term. It is estimated that collecting 100 euros requires 10 euros spent on human and technical resources. A portion of this funding might come from external sources such as international lenders, but in reality such organizations will only provide funding for capital investments and related outgoings (support, technical assistance and capacity strengthening, and still from a capital investment standpoint and strictly over the short term). Development aid provides nothing for operational expenditure, which is every bit as much a financial burden. Operational costs are the responsibility of cities themselves, despite their extremely limited means.

Without information it is impossible to build a land registry system, and without a land registry it is impossible to collect the taxes needed to finance shared services

¹ WHO, 2015



Wexity software interface - ©Wexity-Logiroad

HIGH-POTENTIAL INNOVATIONS TO DELIVER CONTROLLED URBAN PLANNING

DIGITAL TOOLS AT THE SERVICE OF CITY PLANNERS

The quality of urban and land use information does not depend on any form of technology – remember that land registries have existed since cities first emerged some 7,000 years ago. Better technology is not an end in itself but can help collect, process and share data. Digital transition can provide a set of technology innovations that make it possible to collect and process data in ways that are rapid, accurate and inexpensive. For land use management, new technologies make it possible to develop alternative forms for managing land tenure and addressing, storing data online, sharing information and working in networks. Digitization makes it possible to leap directly to digital without ever needing to create paper-based land registry records.

Urban planners now have a range of new digital tools at their disposal, including:

- satellite cartography, which has revolutionized geographical information. For many years, it was necessary to charter an aircraft if you needed aerial views of a city. Today, this is almost instant and free thanks to the Google Earth and Open Street Map databases.
- photo-interpretation software, which transforms satellite images into plan images.

- addressing and door-to-door data collection operations can be carried out using a tablet or smartphone and geolocation. The internet makes city-wide quantitative studies possible as it is easy to send questionnaires to residents.
- crowdsourcing techniques with resident participation can also be invaluable to urban planners. For example Know Your City, a campaign designed by Shack/Slum Dwellers International, promotes participative mapping in informal settlements.

There is a vast field of possibilities that offer new perspectives for urban planners. In 2017 Groupe Huit, in partnership with Orange and the French Development Agency (AFD), carried out a study of mobility in the Dakar agglomeration. Using cellphone data supplied by Orange, planners were able to map the daily journeys, from home to work and back, of thousands of people. The data were then modeled to extrapolate patterns across the city as a whole. This made it possible to accurately and exhaustively map primary journey flows.

The obstacles to planning are not the technical tools, as these exist; the obstacles are rather the ability of municipalities to lastingly appropriate those tools and provide them to staff charged with managing the territory and its services. Many city councils in Africa do not have the means to employ planners and specialists capable of processing and sharing city data, or have little access to such professionals as these skills are relatively rare on local labor markets.

Domains handled by Wexity - ©Wexity-Logiroad

WEXITY, A TURNKEY TOOL FOR CITIES

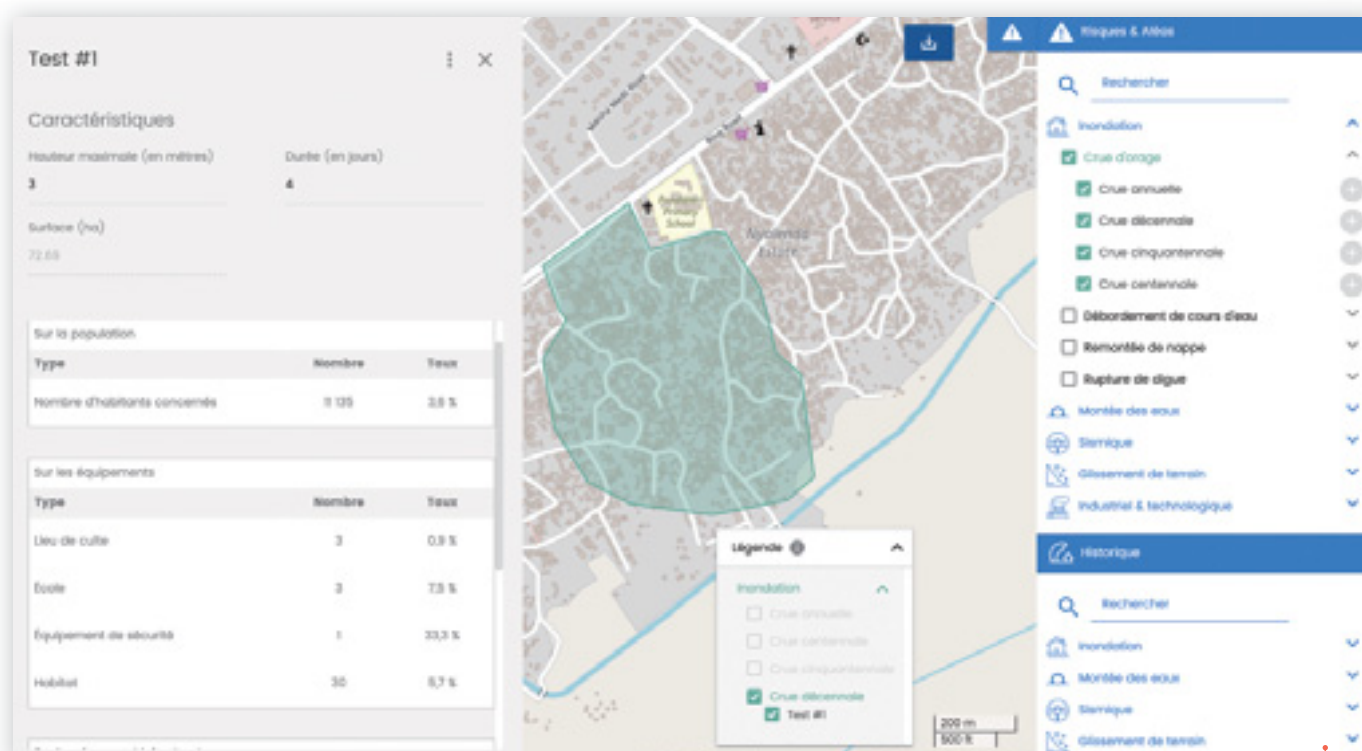
The Wexity platform from Logiroad started from the realization that one of the brakes on planning is not technology but knowledge sharing. Wexity is an IT tool used to assemble all city data on a single platform and to manage all the related components (utility networks, habitat, environment, local economy, tax system, etc.). Previously, the only IT planning systems available were complex and required skilled in-house staff who are hard to find and GIS-type tools that also need expert users, who are also hard to find and expensive to employ. On occasion, urban modeling solutions can be so complex that they require permanent oversight by international experts, even after extensive local training.

The first innovation offered by Wexity is a clean break from this overly complex model, with an interface that is simple to use. The platform adapts to suit its users' varying degrees of expertise, whether elected officials, city executives or municipal employees. The core aim was to build a tool that would be easy to learn for everybody in a municipality who needs to use it. This implied offering a solution that people could learn how to use quickly and would then be happy to keep using. Wexity is a ready-to-use solution that can be set up simply by entering the city's administrative boundaries, loading

Wexity software is capable of producing result-oriented analyses: how many residents live in flood zones? Which installations face environmental risks? Where are the areas without access to safe drinking water?

existing data and creating user accounts. This makes it very fast and inexpensive to set up, but most importantly of all it means that useful urban planning work can get under way rapidly, collecting data and producing results. Wexity makes it possible to opt for shared and collaborative working methods. The platform gives municipal staff the chance to work in networks rather than silos, which is still too often the case. This practice, absent from other available urban planning IT systems, re-establishes coherency in urban planning by allowing all decision-makers to work on a single platform at the same time and with the same data. It can then be used to establish relationships between the data and the needs that a municipality may face. This means, in particular, that the software is capable of producing result-oriented analyses: how many residents live in flood zones? Which installations face

environmental risks? Where are the areas without access to safe drinking water? Which residential areas are furthest from schools?, etc. These are all straightforward questions, but ones that municipalities are not always able to answer without turning to consultants in a process that is generally long and costly. The algorithms used by Wexity automatically detect needs in different neighborhoods and transmit this information to municipal departments that are then able to take rapid remedial action.



View of flood risk in a district - ©Wexity-Logiroad

In concrete terms, the Wexity platform from Logiroad incorporates the following functions:

- ready-to-use GIS (Geographical Information System)
- city database including non-cartographic data (demographic, socioeconomic)
- library of urban objects, used to classify all elements of the city
- analytical module for cross-referencing all city data
- SaaS (Software as a Service) database
- standards adaptable to any city, anywhere in the world
- module for managing data obsolescence.

Over and above being a digital tool specially tailored for the cities of Africa, Wexity is a project focused on capacity strengthening. The Wexity teams make sure to set up a local city data team that serves as a laboratory for re-thinking the city. This local team is trained so that it can be quickly and enduringly autonomous.

TECHNOLOGY WILL NEVER BE A PANACEA FOR SUCCESSFUL CITY PLANNING

Technological or managerial innovations alone will never genuinely revolutionize how cities are planned and managed. The ability of cities to finance these changes, which implies raising tax revenues, must not be ignored. If taxation systems remain inadequate in most African cities, it is because political leaders are unable to enact far-reaching fiscal reforms. Fiscal reform is counter-productive in terms of the political calculations that govern the

thinking of local leaders and external lenders. Improving the system is an extremely long and involved process, and only the drawbacks are ever pointed out, with the short-term advantages hard to discern. It's a process certain to be unpopular, as people who are already poor have very little inclination to accept tax hikes to finance public services that they don't yet have access to. For lenders, supporting reform of the tax system is a small-scale project that requires little expenditure compared to the scale of the investments needed, and is something that demands specific support over the long term.

Cities have a broad spread of tax instruments available to them (levies, business taxes, fees for exploitation of natural resources, land taxes, etc.). Keeping in mind that Rome and Babylon managed to fund their growth by raising taxes two to three thousand years ago, it's a question that is not so much technological as institutional: how do you incite the entire local administrative system to change? The role of technology is to act as a catalyzer by optimizing systems for tax collection, issuing tax demands or maybe using cellphones to make payments. There are no technical reasons that prevent deploying these types of solutions.

AFRICAN CITIES IN 2030: CONDITIONS FOR SUCCESSFULLY CREATING A CITY THAT IS CALMER AND MORE PLANNED

REASONS FOR OPTIMISM

The outline above shows urbanization in African cities as an inflicted phenomenon freighted with inevitable social, political and environmental problems. But there are reasons to be optimistic about advances in urban planning and access to essential services in the city.

- First, people want to see change and are themselves a hotbed of initiatives. The youthfulness of African people – 60% of Africans are aged under 24² – represents a great opportunity and a source of dynamism for the years ahead.
- Next, it would be a mistake to underestimate the political will of mayors across Africa to change approaches to urban planning. As part of efforts to promote Wexity commercially, we encountered clear enthusiasm for new city planning tools among local politicians and a clear determination to use them to improve the range of services offered to residents. In Senegal, for example, many municipalities have ambitious land use and tax projects. These may not yet be ready for deployment, but there is widespread acceptance of the need to improve management of land use and tax systems.
- Global geopolitical shifts and the rise of new powers may change the balance of power in North-South relations and augur the establishment of new ties between the hemispheres in terms of development.
- A new acceptance among the international community of the need to create and roll out local urban planning systems is making a difference. For example, UN Habitat's New Urban Agenda, adopted in fall 2016, assumes that urban planning is the core tool and component of urban development.

The only question is the timeframe. These are long-term changes: it takes 10 or more years for land use and tax reforms to produce tangible benefits. It will probably be closer to 2040 before major change will become clear on the ground.

THREE CONDITIONS FOR SUCCESS

GOVERNANCE AND INSTITUTIONS

Nothing can be done without genuine political will. Fiscal reform cannot be driven by administrations that are hesitant or hamstrung by conflicts of interest. For the urban data essential for the establishment of shared services, improving ways in which data are collected and processed is also a political issue. All too often, certain municipalities are reticent about collecting quality urban data because this may shine a light on the true extent of their failings in terms of the provision of public facilities. Building local capacity needs to take place outside the constraints of electoral mandates.

CHANGE MANAGEMENT

The success of an urban plan is heavily dependent on the willingness of local leaders to commit for the long term, to collaborate, change their working habits and take risks. Planning is fundamentally a political process, requiring that issues surrounding stakeholder consultation and involvement be addressed. Urban planning raises many change management issues. This means that local teams need support and time to get used to new tools and procedures. The key is having a commitment to a long-term process and the active backing of teams from the local administration, without whom nothing can be achieved.

PLANNING MUST BE REALISTIC TO REFLECT AVAILABLE MEANS

African municipalities have been designing urban plans for more than 50 years, too often with zero noticeable results in terms of social and economic development. The plans are usually very well designed, but in most cases their failure on deployment results from a lack of realism about the means available to city halls. With 56% of the population of towns and cities in Sub-Saharan Africa living in informal settlements, the challenges to urban development are colossal³. Without access to reliable data it is hard to prioritize and select key sectors or neighborhoods to target. Urban planning must adapt to the city, not vice versa.

CONCLUSION

Running a city and financing shared services costs a great deal of money; wherever you are in the world, this has always been the case. African cities have two priorities if they are to move from inflicted to controlled urbanization: optimize land use management and improve local tax systems, to give them the capacity to operate an efficient local administration. The tools to improve land use management exist and have been known for many years (land register, addressing, zoning plan, etc.), but first of all the basic data have to be accessed and managed. However, collecting and updating data is a costly undertaking. This is where recent technologies are of interest, offering a range of new tools to assist planners. The challenge is to help local authorities take ownership and incorporate these tools at every level, human and organizational in particular. The innovations that will help bring about real change in African cities are those that combine technology with capacity strengthening to spread expertise throughout the cities and develop solutions that align with local contexts. These technical and technological tools will never be the sole solution for successful urban planning, but they are an indispensable complementary resource in the light of the global challenge represented by the growth of cities in the Global South. They can play a twin role as facilitator and detector while simultaneously optimizing management of land use and local tax systems, which lie at the center of the development of city services.

² Department of Economic and Social Affairs, UN, 2015

³ UN-Habitat, World Cities Report, 2015

DECENTRALIZED ELECTRICITY SOLUTIONS: innovation in essential services is no substitute for policy

Sylvy Jaglin
Researcher at LATTS and professor
at Université Gustave Eiffel

Emmanuelle Guillou
PhD student at LATTS



Sylvy Jaglin is a professor in Urban and African Studies at Université Gustave Eiffel. Her research activities take place at LATTS (Laboratoire Techniques Territoires et Sociétés) and focus on urban infrastructure and services, and energy transitions in cities of the South, with a special interest in Sub-Saharan Africa.

Emmanuelle Guillou is a post-graduate student in urban planning at LATTS. Her thesis, directed by Sylvy Jaglin and carried out within the company Hydroconseil, examines electrical mini-grids and small private operators in peri-urban areas of Sub-Saharan Africa.

The African electricity sector has undergone profound change in recent years. Off-grid solar solutions are now very much part of the new-look industry. But lack of coordination between authorities and, crucially, the uncertainty that persists surrounding the long-term future of off-grid installations in the face of the stated desire to extend national power grids, combine to slow the uptake of off-grid solutions. This situation favors certain intermediaries in the market, such as startups and small-scale resellers of solar-powered items. Whereas some rely on quality of customer service and advanced technologies (modular battery solar home systems, or SHS, and interconnections between individual solar kits), others exist to meet demand for low-cost solar-powered items. Questions arise concerning how public policies and market mechanisms interact. Current regulations lack a holistic vision and joined-up thinking, meaning it is not yet realistic to think in terms of hybridization.

INTRODUCTION

Technological innovations and new off-grid solutions are leading many experts to predict an electrical revolution in Sub-Saharan Africa, where 620 million people remain without access to electricity (Africa Progress Panel, 2017). Almost 26 million African households (around 100 million people) already have access to electricity via decentralized forms of energy production (IRENA, 2016) and new projects are springing up daily across the continent (Jacquemot and Reboulet, 2017). However, reports from the field reveal contrasting processes at work. Although governments always claim to embrace innovation and enact legislation to promote it, government actions remain inadequate and at times inappropriate. Simultaneously, private sector players are actively creating commercial offers that take advantage of available new technologies, but without ever making universal provision a reality. The diversity of emerging configurations for electrical supply and the territories concerned make it difficult to define conditions for an energy transition capable of delivering access to electricity that is technically reliable, economically viable and socially acceptable.

This article examines two case studies, from Tanzania and Senegal.¹ It sets out to examine the processes of change and the roles of market mechanisms and public policy-making. It then looks at the social and spatial impacts of the deployment of off-grid solutions, identifying the population groups and territories that these new offers appear to benefit above others.

¹ Data from qualitative surveys conducted in 2018-19 by Emmanuelle Guillou for a doctoral thesis.

PUBLIC ACTION AND TECHNOLOGICAL INNOVATION

In every country of Sub-Saharan Africa, national actors are incorporating technological innovations and decentralized solutions into their electrification policies and programs. These are built on a diverse range of contract arrangements with private partners and they generally differentiate between urban and rural localities, for which different sociotechnical offers are designed, that reflect the dominant representations of the territorially based needs and social functions of electricity (Jaglin, 2019).

In Senegal and Tanzania, successive reforms of the electricity sector have led to spatial differentiation in electrification modes, with the creation of specialized agencies for rural zones and, in recent years, the promotion of access via off-grid solutions.

TECHNOLOGICAL INNOVATION AND ROLLING OUT ELECTRICITY TO RURAL AREAS

In both countries, the 2000s were marked by a succession of institutional reforms intended to deliver “access to affordable, reliable, sustainable and modern energy for all” by 2030 (SDG 7).

In Senegal, the 1998 reform of the electricity sector led to the creation of a Senegalese agency for rural electrification

(ASER) and an industry regulator (CRSE). Similarly, the 2005 reform in Tanzania created the Rural Electrification Agency (REA), and the Energy and Water Utilities Regulatory Authority (EWURA), the industry watchdog. Initially controlled by major national operators (Sénélec in Senegal and TANESCO in Tanzania) or international operators (concession operators in Senegal), since the mid-2000s rural electrification has been open to small private operators. Supported by lower administrative hurdles and new financing sources, this wave of liberalization favored decentralized solutions: mini-grids and solar home systems (SHS).

In both countries, rural electrification using decentralized solutions is not an innovation in itself. In Tanzania, for instance, hydropower mini-grids were set up in the 1950s and '60s by large agricultural or industrial companies or by missionaries. More recent initiatives are, however, characterized by two innovations. On the one hand, governments construct an enabling framework coupled to incentive measures; on the other, there is a progressive integration of technological advances (smart meters, prepayment systems, massive use of photovoltaic solar, etc.) enabled by falling costs and rapid uptake. Against this background, two trends emerge following a comparative analysis of national policies.

The climate of uncertainty is heightened in both countries by the ambiguity of the government's position on the future of decentralized solutions

SPATIALIZATION OF OFFERS FOR ACCESS TO ELECTRICITY



Junction point between the Sénélec medium voltage grid and the low voltage network operated by NSRESIF, village of Diaglé



Site of the Kéré mini power plant, operated by SALENSOL



SHS installed by a household in the village of Darou Djaji Guéyène, operated by NSRESIF

Emmanuelle Guillou - Source: field observations

Figure 1

The Senegalese approach is prescriptive, classifying rural areas on the basis of geographical, socioeconomic and technical criteria (distance from the grid) and then inviting tenders from actors of various types. This means that a village located close to an existing national infrastructure will be connected, whereas a densely populated village in a more out of the way area will be fitted with a mini-grid, and a sparsely populated village in a remote area will be targeted for SHS-type solutions. This way of organizing the various technical solutions between villages, and even within the same village, institutes a spatial hierarchy between levels of service, from the most basic (lighting and small-device charging with SHS) to the most complete (usage via a grid connection).

In Tanzania, the approach is more incitement-led, consisting of promoting the development of certain supply models through differentiated subsidy payments according to the technologies used by developers of decentralized solutions. But this style of intervention has evolved to reflect technological advances and political choices.² The Rural Electrification Agency (REA) supported the distribution of “solar gadgets” (small solar torches, batteries, etc.) between 2007 and 2012, then favored SHS for community facilities as of 2010, before promoting mini-grids in 2014. But, in 2014, the REA decided to stop making its aid conditional on a type of technology and to think instead in terms of access: from level 1 (SHS electrification) to level 5 (solution supplying a grid-equivalent service). A separate budgetary envelope is defined for each level. To a certain extent, the REA is thus able to indirectly influence the type of solution deployed in a territory as well as the type of supplier. For instance, operators able to provide level 5 access are inevitably major companies with a well-established activity in the territory.

In both countries, incorporation of technological innovations is seen as necessary for the viability of off-grid electrification solutions. The first step is incorporating innovations that facilitate the use of solar energy: using a local energy source allows to put aside the question of the cost of transmitting electricity to isolated areas; project owners are eligible for international funds and subsidies to promote “clean” energies; reduced production costs improve the chances that the service will be profitable. There is also an emphasis on using digital technologies, such as smart meters, that deliver lower operating costs via remote monitoring, and prepayment solutions that are more appropriate for customers with variable incomes.

POLITICAL AND REGULATORY FRAMEWORKS FOR DEPLOYMENT: CREATING UNCERTAINTY

On paper, national policies in place since the late 1990s put considerable emphasis on decentralized solutions and technical innovations. In reality, deployment of national strategies is hampered by states’ patchy financial and

organizational capacities, resulting in actions that are uncoordinated, inadequate and at times inappropriate.

The large number of principals and the lack of coordinated public action make the situation hard to read for developers of decentralized solutions and consumers. In Senegal, national agencies for rural electrification mushroomed in the years after 2010 as a result of policies seeking to promote renewable energies. A National Eco-village Agency and a National Renewable Energies Agency were created in addition to ASER and Sénélec. Besides

the programs run by these agencies, the ministry of Energy controls the Emergency Community Development Program. Lack of national coordination between these multiple decision-making hubs leads to overlapping programs with reduced accountability. In Tanzania, all cases touching on the rural electricity sector are theoretically managed by the

REA. In practice, mini-grid operators deplore the lack of coordination of electrification projects as a whole and the absence of precise information about plans for extending the national power grid. It is not unusual for them to discover that the grid is about to arrive, just months after installing their equipment in a locality. This lack of certainty has a dissuasive effect on investors, who are increasingly wary, and it leads to more and more “grey areas” too close to the main grid to convince off-grid solution operators to set up, but too distant to be connected quickly.

For a decentralized system operator to commit depends also on the fate of the installation once the locality is connected to the national grid. The legislation differs in this regard. In Senegal, the law requires mini-grid operators to withdraw under all circumstances, which does nothing to encourage investment to expand facilities and leads to inadequate capacity at many mini power plants. The main rural electrification program further embeds this restrictive approach to rural power, for example by installing systems that cut the supply once a daily quota is exceeded. Mini-grid operators justify the installation of these mechanisms by the need to control and ration the amount of electricity used because of limited power plant capacity. In this case technical innovations are being used paradoxically – facilitating access while limiting usage to essential functions only. These practices lead to two-tier electrification, with differences between people connected to the Sénélec grid and users of off-grid solutions, who are restricted by under-sized installations and lack of investment. By reinforcing consumers’ general dissatisfaction, this situation accentuates a general mistrust regarding solar technologies among those surveyed, equating it to a form of provisional pre-electrification, and there is a clear preference for a conventional grid connection. Once a grid extension seems probable, some villagers prefer to abandon alternative forms of electrification for fear of being ineligible for a Sénélec connection.

Technology alone is not sufficient to promote a successful policy for access to essential services

² Interview with a REA manager responsible for developing the electricity and technology market, October 2 2019, Dodoma (Tanzania).

In Tanzania, the national grid does not enjoy a territorial monopoly and current legislation allows a local operator to remain in a village connected by TANESCO. But there are other factors at play. Better-off users may move away from mini-grids because of high tariffs, whereas poorer users comprise a captive client base in the absence of subsidies for a connection to the national grid. Faced with lower profitability caused by the (partial) loss of larger users, mini-grid operators can also be tempted to pull out of a village, disconnecting households that rely on it exclusively. Finally, the law allows grid feed-in for mini-grids with a capacity of 0.1 to 10 MW, and some operators have used this as an opportunity to stabilize their business model by selling their production surplus to the national operator, which provides demand that is both high and relatively stable.

More noticeable in Senegal than in Tanzania, the climate of uncertainty is heightened in both countries by the ambiguity of the government's position on the future of decentralized solutions. On the one hand, they encourage and subsidize the entry of private actors into the market as a way to rapidly improve access to electricity. On the other hand, these incentives coexist alongside with a political discourse that stresses the goal of connecting the entire country to the electricity grid. Although not explicitly stated, the scenario considered relies on a linear transition leading to residual off-grid electrification in areas that are too isolated or insufficiently cost-effective. Yet, technically and financially, this scenario seems barely credible in the short or medium term.

DIVERSITY OF PRODUCTS SOLD BY PRIVATE ACTORS IN SENEGAL AND TANZANIA



SHS sold in a store in Kaolack, Senegal



Energy kiosk fitted with a mini solar power plant in Komolo village, Tanzania



Photovoltaic solar panels sold by a hardware store in Kaolack, Senegal



Local outlets distributing Sun King products in a peri-urban area of Arusha, Tanzania



Small solar-powered items sold on the market in Kaolack, Senegal



Display models showing the range of Sun King products at the company head office, Arusha, Tanzania

Emmanuelle Guillou - Source: field observations

Figure 2

NEW MARKETS CAPTURED BY POORLY REGULATED PRIVATE ACTORS

Due to this combination of regulatory incentives with restrictions, public action leads to contradictory relationships with technical innovations and new decentralized installations. Even so, these relationships only very partially reflect the changes under way. To understand how technological innovations incorporated into decentralized mechanisms for access to electricity are disseminated and appropriated, it is necessary to examine the entrepreneurs and intermediaries active in the market, as they also take ownership of these innovations to develop new offers targeting specific customer segments.

DEFICIENCIES IN THE PUBLIC ELECTRICITY SERVICE: BOON FOR COMMERCIAL ACTORS

There are numerous more or less formal actors in the off-grid electricity sector, with a highly diverse range of structures, resources and networks.

A first category includes overseas startups, often from Europe or the USA, and specialist retail outlets that have sprung up in all the major urban centers. These businesses generally distribute individual solar kits, or install and operate solar or hybrid mini-grids, or both. Most of them do more than just supply electricity, trying to stand out from their competitors and the national operator by diversifying their line-up of products and services: credit sale of electrical appliances to households and small businesses, creation of Wi-Fi zones in villages, installing public lighting free of charge, supporting village entrepreneurs who want to launch new activities, aftersales services, etc.

The second category includes small stores and traveling resellers. These traders tend to focus on the sale of photovoltaic solar panels, SHS and small solar-powered items, often imported from China and sold at prices attractive to customers with only modest incomes. Most of these are new to the trade, which they combine with other types of commercial activity. They do not offer credit and provide no guarantees, aftersales support or installation services.

These off-grid solutions attract two customer segments.

On the one hand, residents of rural areas not connected to the national grid, a group targeted as a priority by private actors in the first category. Given the limitations of public action for rural electrification, these actors have developed commercial strategies focusing on three key factors: proximity (setting up as close as possible to customers), customer service (delivery, home installation, guarantees, technical support), and flexibility (large range of solar equipment, extensive choice of payment options). The startups adopted pay-as-you-go and mobile payment from the outset, by establishing partnerships with national cellphone operators. And the equipment offered is ever more closely aligned with customers' real needs: in Senegal, a company called Ilemel sells a modular SHS that

allows batteries to be added directly to the basic model, increasing the power available, and Sud Solar claims to be considering an SHS-nano-grid hybrid system that allows progressive interconnection of individual solar kits installed in villages it serves.

On the other hand, these commercial practices, coupled with technical innovations, attract to off-grid solutions other customers who are or feel excluded by public policies. Included in this group are people already connected to the grid, often in towns and cities, who see these new electricity services as an alternative to a patchy and deficient national grid. In Senegal and Tanzania, more and more households are fitting photovoltaic solar panels as a back-up or to reduce their electricity bills. In Tanzania, some industrial and agricultural businesses are setting up hydropower mini-grids either as a standby or primary source of electricity where this appears more reliable and cheaper once the upfront investment is made. The emergence of this second group of customers is a boon for distributors as it allows them to consolidate their business models by serving a solvent customer segment. Companies like Zola, a well-established company in Tanzania, have even gradually developed specific products targeting this new type of customer: these are more costly but allow the connection of more power-hungry household appliances.

REGULATION NEEDED

The spread of these decentralized solutions for access to electricity has not been met with sufficient and appropriate regulatory responses. Variable oversight of the different forms of off-grid electricity supply is evidence of the slow pace of public action compared to the pace of changes in the market.

Although mini-grids are controlled by national regulators that deliver production and distribution licenses and set prices, distributors of solar equipment are not required to obey technical standards and are free to sell whatever they want. In Senegal, despite protests from rural electrification concession operators and some mini-grid operators, the government has opted for a *laissez-faire* policy to avoid hobbling the activities of private operators, whose investments are indispensable. In Tanzania, the lack of any regulation for competition between authorized companies and informal small traders led several formal companies in Arusha to close down.³

Deficiencies in regulatory frameworks favor the emergence of informal methods of regulation and opportunistic business practices. Informal regulations also tend to mirror existing balances of power and entrench the interests of dominant actors. In Tanzania, for example, in a peri-urban area east of Arusha, the national regulator allowed a large-scale farmer to connect villages to the hydropower mini-grid built for the farm and to sell electricity at a price lower than that charged by TANESCO. Feeling threatened by this

³ Interviews with authorized solar equipment traders, October 2019, Arusha (Tanzania).

alternative offer, the national operator then pressured the competitor to prevent any extension of the mini-grid beyond the farm limits.

CONCLUSION

Technical innovations and initiatives based on massive use of renewable energies are cropping up all over Africa, where the electricity sector is undergoing profound transformation, but without as yet offering any guarantees on universal provision of essential electricity services. This is caused by stereotypes about the electricity needs of rural areas that form the basis of much public policy-making and result in normative conceptions of the potential of off-grid solutions. As their deployment is reserved for certain types of locality or population group, who are in turn subject to uncertainties about timeframes and types of installation, preferences for a connection to the conventional power grid persist.

Meanwhile, capitalizing on opportunities and expectations created by these overly restrictive strategies, private actors supply new market-led solutions adapted to suit various solvent customer segments. Flexible and responsive, these initiatives produce a wider range of products and at prices that are more affordable for a greater number of people. But in the absence of a holistic overview of these evolutions, public regulations fail to get to grips with either the range of initiatives, private in particular, or the resultant mixture of overlapping methods for gaining access to electricity. And this undermines the results. First, the lack of joined-up thinking means some measures discourage initiatives by private actors, who are unwilling to invest in a climate of uncertainty. Even as pragmatic public action on the ground assists the deployment of decentralized solutions, political messaging and national regulatory frameworks continue to espouse the ideal of universal electrification delivered via the national grid. Although the term “pro-poor” is often quoted in the literature when describing individual solar solutions, these remain unaffordable for whole sections of the population (Bensch *et al.*, 2016). The beneficiaries in the rural world are not, in fact, the poorest, and some of the commercial effort is concentrated on consumers in urban areas. This leads to inequalities and new electrical divides, reflected in the contrasting levels of development seen in no-service grey zones compared to zones where many different solutions are available to people who already have a grid connection.

Technology alone is not sufficient to promote a successful policy for access to essential services. In the countries studied, as in many other countries of Sub-Saharan Africa, compartmentalized policies for rural electrification and overly restrictive visions of energy transition inhibit an understanding of all the forces at play and their impacts on hybridization processes (Jaglin, 2019). This also means that the need for socio-spatial regulation of inequalities is being overlooked. In the absence of overall coordination,

the mechanisms used by the various actors to offer decentralized solutions lead to a segmented service, not to a policy delivering justice in terms of access to electricity. This will not come about through technical innovation alone. It is first and foremost a question of political choices.

REFERENCES

- Africa Progress Panel, 2017, *Lights, Power, Action: Electrifying Africa* – report summary, Africa Progress Panel, s.l.
- BAD, 2017, AfDB Group’s Strategy for the New Deal on Energy for Africa 2016–2025, BAD, Abidjan.
- Bensch G., Grimm M., Huppertz M., Langbein J., Peters J., 2016, *Are Promotion Programs Needed to Establish Off-Grid Solar Energy Markets? Evidence from Rural Burkina Faso*, RWI (Ruhr Economic Papers #653), Essen.
- Berthélémy J-C., Béguerie V., 2016, *Introduction. Decentralized electrification and development: initial assessment of recent projects*, Field Actions Science Reports, Second semester, p. 4-9.
- Grimm M., Peters J., 2016, *Solar off-grid markets in Africa. Recent dynamics and the role of branded products*, Field Actions Science Reports, Second semester, p. 160-163.
- IRENA, 2016, *Roadmap for a Renewable Future*. 2016 Edition, Abu Dhabi, International Renewable Energy Agency.
- Jaglin S., 2019, *Electricity Autonomy and Power Grids in Africa: from Rural Experiments to Urban Hybridizations*, in Lopez F., Pellegrino M. and Coutard O. (editors), *Local energy autonomy: spaces, scales, politics*, London, Iste Publishing, p. 291-314.
- Jacquemot P., Reboulet M-N., 2017, *Options technologiques et modèles d’organisation de rural électrification en Afrique: Retours d’expériences* [Technology options and structural models for rural electrification in Africa: lesson learned], *Afrique contemporaine* (1) 155, p. 261–262.

WASTEWATER REUSE: A SOLUTION WITH A FUTURE

Christophe Maquet
Executive Vice-President Africa and Middle East, Veolia



Windhoek wastewater recycling plant - ©Veolia

Christophe Maquet has been Veolia's Executive Vice-President for Africa and the Middle East since January 2019. A graduate of the Paris Ecole Polytechnique and the Ecole Nationale des Ponts et Chaussées engineering school, he joined Veolia in 2004 as a financial controller. From 2007 he was part of the Group's drive for international industrial expansion in the energy, waste and industrial water sectors, first in the Middle East then in Asia.

Veolia's Africa and Middle East zone employs 9,000 people across 15 countries, providing the resources needed to ensure the wellbeing of communities, to make regions attractive and underpin the performance of businesses. It generates annual revenue of €1 billion.

A combination of water stress, fast-growing populations and the climate emergency means many African countries struggle to provide their people with sufficient clean water. For these countries, in addition to saving water, the solutions lie not so much in sharing a scarce resource as in turning to non-conventional alternative water resources, for example seawater or wastewater in place of raw water from rivers or aquifers. It is little surprise that we are seeing the emergence of ever more projects to give water a second life. Reusing wastewater seems to be the most effective bulwark against scarcity.

Recycled wastewater is the only resource that increases in step with economic growth. It is a virtuous solution that protects nature by limiting the risks of pollution discharges into the environment. It is a circular economy model that strengthens countries' water self-sufficiency by giving them access to a reliable resource located within their territory, and therefore protected from adventurous neighbors.

Veolia has developed innovative solutions for reusing wastewater in industry and agriculture as well as the home. One of the pioneers is the Namibian capital of Windhoek, where 35% of the drinking water needs for the city and its surrounding area are met using recycled wastewater. Is this a pointer to the future?

INTRODUCTION

"In Windhoek, every drop of water counts" is the motto of the Namibian capital. Namibia is one of the world's most arid countries, traversed by the Kalahari and Namib deserts and bordered by the Atlantic Ocean to the west. In Namibia, heat causes 83% of rainwater to evaporate, with just 1% absorbed into the ground. With chronic water stress and no nearby water courses, in 1968 the city decided to recycle wastewater for reintroduction into its water supply network, making it the first city in the world to reuse domestic wastewater for human consumption.

The policy provided an additional water source for over 20 years, but was soon under pressure from Windhoek's rapid population growth following independence in 1990. In 2002, a new treatment plant was built and handed over to Veolia to operate. With a daily capacity of 21,000 cubic meters, the plant currently supplies over a third of the city's drinking water in the form of tap water used by almost 400,000 residents.

MULTIPLE-BARRIER TREATMENT REPRODUCES THE NATURAL WATER CYCLE

Windhoek's water treatment plant uses cutting-edge technologies that mimic nature to eliminate all possible health hazards. Domestic effluents are first treated in the City wastewater treatment plant (WWTP) using an activated sludge process and maturation ponds. They then pass into the DPR (Direct Potable Reuse) plant where several treatment steps mimic the natural water cycle and ensure a water quality that meets the world's highest standards. A number of innovative technologies have been deployed, including biological filtration and granular activated carbon filtration. Critically, the multiple barrier technique reproduces the natural water cycle in several phases: pre-ozonation, coagulation/flocculation, floatation, sand filtration, ozonation, filtration, activated carbon adsorption, ultrafiltration and chlorination. These different phases have the advantage of eliminating a number of the primary elements in wastewater, such as physical and organoleptic elements, macro-elements, and microbiological and disinfectant by-products.

The resulting potable water is subject to permanent quality controls. This is key to the safety of water sources as well as to public trust. All routine testing – physical, inorganic and organic chemistry, microbiology and viral indicators – is carried out in the city's analysis laboratory. There is also a program for managing health risks that feeds into a number of research projects. These encompass advanced testing for virology, parasites, toxicity, pesticides, algae toxins, etc.,

carried out by third-party laboratories. And as the plant is fully automated, an online sampling system is located in each primary treatment unit to provide continuous inspection of turbidity, pH, conductivity, dissolved oxygen, chlorine, etc.

In total, it takes around 10 hours from the moment wastewater arrives at the treatment plant to the moment it leaves as drinking water. This high-quality recycled water resulted in the installation of new water distribution points in townships, helping to improve the health and safety of residents.

The Windhoek treatment plant has become a global benchmark and a model for innovative and sustainable water management. It is also an example of a successful public-private partnership that is increasingly visited by officials from across Africa as well as numerous experts from Australia, Singapore and the USA.

UNTAPPED POTENTIAL CAN PROVIDE ACCESS TO WATER FOR MOST PEOPLE

The Windhoek case is the longest-running and most emblematic project for the direct reuse of treated wastewater for the production of drinking water for human consumption. But direct reuse of wastewater without a passage via the natural environment remains extremely rare. Worldwide, only 4% of wastewater is recycled. And it is a resource most commonly destined for uses other than tap water.



Wastewater goes through multiple barrier treatment at the Windhoek reuse plant - ©Veolia

The full potential of wastewater remains very much under-exploited. But this is a “new black gold” according to a 2017 UN report on wastewater released to coincide with World Water Day. The report’s authors suggested that we should think of wastewater as a resource. Reuse is an inescapable solution if we are to limit the ballooning demand for water caused, in every corner of the planet, by population growth, better living conditions in developing economies, urban growth and the demands of agriculture.

Water is a resource under pressure and, although the first response is to optimize consumption, reusing recycled wastewater is a way to protect this resource. Take agriculture as an example. The use of recycled wastewater for irrigation represents 32% of the global market, but this use could become far more systematic. Wastewater is rich in nitrogen and phosphorus so it can provide nutrients to crops. The critical challenge for agricultural irrigation is to preserve a portion of the nitrogen and phosphorus contained in the wastewater, because these are valuable nutrients for plants. This also avoids using fertilizers that are energy- and resource-intensive to manufacture, particularly with phosphorus potentially in short supply by 2050.

Providing access to water to the majority of people while also protecting the environment is a twofold objective that wastewater reuse delivers – it is a solution with a future.

After irrigation for agriculture, reuse is primarily focused on watering green spaces (20%) and in manufacturing (19%). To recycle water is to boost its productiveness. This is a key issue for manufacturers when you consider that it takes 400,000 liters of water to make a car, 11,000 liters to make a pair of jeans and 1,300 liters for a cellphone. This is what we are doing in Durban, South Africa, where we recycle 98% of the wastewater from the city’s Southern Wastewater Treatment Works (SWTW) for reuse by manufacturers in their production processes.

Veolia put this virtuous solution for adapting to the climate emergency in place as part of South Africa’s first ever public-private partnership.

Recycling water for industrial applications means less water has to be taken from the natural environment and freshwater resources can be reserved for the production of drinking water. The plant can indeed provide an additional capacity of 47,000 cubic meters of drinking water each day, equivalent to 13 Olympic-size swimming pools.



In Durban, wastewater is reused for industrial purposes - ©Veolia

And as water can account for as much as 15% of industrial costs (process water, hot water, air conditioning, washing, etc.), the reuse of recycled wastewater is a fantastic opportunity in terms of cost control: the Durban-based manufacturers partnering with the project save over €5 million a year.

The time has come to think differently about the water we drink, the water that is used to irrigate fields, water parks and gardens or as part of industrial processes, before it is returned to nature.

There is, however, no escaping the fact that this alternative solution will develop at different rates in different parts of the world, reflecting the specific requirements of each local regulatory environment. It also suffers from problems of social acceptability and, despite all the economic and environmental advantages, projects involving reuse of wastewater can be a source of concerns. Recycling equates to waste reuse and, no matter its potential, this is something that remains unacceptable for certain religious or cultural reasons. In all cases, these types of projects have to be backed by the full range of educational and awareness-raising measures that are vital to gaining the trust of all stakeholders concerned. Responding to community anxieties is absolutely critical.

CONCLUSION

The Windhoek experience demonstrates that it is possible to boost a city's drinking water supply by using recycled wastewater in a safe and responsible manner. However, operating wastewater retreatment plants requires exemplary professionalism and faultless reliability. These are preconditions for ensuring consumers' health.

Depending on uses and needs, wastewater treatment plants could provide water of a quality suited to every situation. Regulations permitting, we can provide high-quality drinking water in this way thanks to innovative treatment and surveillance technologies that guarantee the absence of any risk to human health.

Under these conditions, are we ready to put our worries and taboos to one side and use recycled wastewater on a daily basis? It all depends on the planned uses, of course, but growing awareness of the environmental emergency and fears of water stress, coupled with technologies that are now mature, should mean that reuse cements its position as an effective solution for guaranteeing access to water in the years to come.

This is a solution for the future in all parts of an African continent experiencing a population boom that, according to the UN, will mean that 75 to 250 million people will be living in regions grappling with major water stress by 2030.

Wastewater for city watering: an innovative partnership between the city of Tangier and Amendis (Veolia)

Interview with Driss Riffi Tamsamani, Vice-President of Tangier municipality

The Tangier region is suffering from the climate emergency and seeing annual population growth of 3%, leading to a 67.7% fall in water reserves behind the Ibn Battouta and 9 Avril dams in 2020. Working with Amendis, you have rolled out measures to manage the urban water cycle, including treatment and reuse of wastewater from the Boukhalef treatment plant, used for watering royal and private golf courses and municipal green spaces. Looking back, how would you sum up this solution implemented five years ago to adapt to climate change?

Under the terms of our national water strategy, reused wastewater is a major non-conventional water resource. Its recovery and reuse has to happen within the overall regional integrated water resources management policy. Since 2015 the city of Tangier, with over 400 hectares of municipal green spaces and levels in our water reservoirs falling year by year, has opted to phase in reuse of wastewater for watering golf courses and municipal green spaces.

Phase 1:

This phase was unveiled by His Royal Majesty on October 6, 2015. It provides watering for 110 hectares of green spaces at the Qatari Diar golf course thanks to commissioning of the Boukhalef tertiary treatment plant (10,700 cubic meters treated a day), the installation of an 8 km pipe network and construction of a 5,000-cubic-meter reservoir and a 120 liter-per-second pumping station.

Phase 2:

This phase aims to extend the reuse network toward the city center, from the Boukhalef treatment plant, for watering municipal green spaces and the golf course at the Tangier Royal Country Club. This phase includes delivery of several projects, including:

- creation of twin 6,000 cu. m storage reservoirs;
- construction of a 120 liter/second pumping station;
- installing around 21.5 km of pipe.

It also includes creating a second tertiary treatment unit at the Boukhalef plant. Construction began in 2017 and is currently in its final phase. This phase aims to provide



Boukhalef wastewater treatment plant operated by Amendis - ©Veolia



Wastewater from the Boukhalef treatment plant is used for watering golf courses and municipal green spaces in Tangier - ©Veolia

watering for 128 hectares and entered partial service in 2019. As of now, some 115 hectares in the municipalities of Tangier and Gzenaya, including 70 hectares at the Tangier Royal Country Club, are watered using treated wastewater. Work is still in progress to roll out watering to the outstanding 13 hectares during 2020.

Phase 3:

This phase aims to ramp up output to 32,000 cubic meters daily, the current capacity of the Boukhalef wastewater treatment plant, and to extend the watering network to the remainder of the city for watering around 150 additional hectares. Work to extend the treatment plant is now in its final phase and studies for extending the watering network are at the preliminary design stage.

To sum up, reuse of treated wastewater now allows watering of 225 hectares of private and public land in the city of Tangier. This is about 39% of the total area of golf courses and municipal green spaces identified in the city. It has led to savings of around 3 million cubic meters of raw water over the years 2016 to 2019. For 2020, we project savings of around 1.5 million cubic meters of raw water.

The Kingdom of Morocco aims to reuse 325 million cubic meters of wastewater a year by 2030. What are your views on this ambitious target for water reuse and the green economy?

Morocco is located in a region suffering water stress and is vulnerable to the effects of the climate emergency. Morocco has made the green and inclusive economy a strategic pillar of its sustainability policy. This green economy is required to respect ecological balances and must be designed to pave the way to the creation of new opportunities for wealth creation and long-term employment. Institutional, regulatory and financial reforms as well as incentive measures are already in place to help improve integration of environmental factors and spur growth in strategic sectors such as renewable energy, energy efficiency, water saving, sustainable management of solid and liquid

wastes, inclusive agriculture, aquaculture and eco-tourism. Against this background, the national water strategy aims to manage water demand and reuse, focusing mainly on improving drinking water distribution network efficiency, using less water for irrigation, managing and extending the services offered, and conserving and protecting water resources, the natural environment and fragile zones. Morocco has set itself the ambitious target of reusing 325 million cubic meters of water annually by 2030.

On what terms, and for what uses, is wastewater reuse permitted in Morocco?

Wastewater reuse is a solution for the future to combat water scarcity. After treatment, wastewater can be used for a variety of applications including watering green spaces and golf courses, crop irrigation, fire-fighting and street-cleaning, or it can be used to recharge aquifers. The new water law, 36-15, strengthened the legal framework surrounding wastewater reuse (chapter V, section one, articles 64-71). Operators and owners of wastewater treatment plants and authorized standalone sanitation plants that reuse wastewater are eligible for financial aid from the water basin agency, in accordance with conditions set out in the legislation.

In your view, is wastewater reuse a solution that can create synergies between the public and private sectors?

Morocco is determined to mobilize every actor and set up innovative public-private partnerships that will increase amounts invested in projects that respect the environment and are likely to create value-added and lasting employment. The reality is that reusing wastewater is an expensive solution that delivers low returns. This is why it is so important to mobilize all forms of public and private investment when attempting to deliver the related infrastructure. It also demands innovation, research and the use of sophisticated technologies. The Tangier case is one example of such a partnership.

REPATR: EXPERIENCE WITH INFORMAL WASTE PICKERS IN GHANA

Jeffrey Provencal

Founder and Head of Business Development at rePATRN in Ghana



Born and raised in Zurich (Switzerland) to parents of Ghanaian descent, Jeffrey Provencal grew up between two cultures. He studied banking and finance, before working at BlackRock for a few years. Looking to engage in a more purpose-driven activity, he later came across the concept of impact investing and chose to redirect his career path. In 2015, after winning a grant from the European innovative fund EIT Climate Kic, he created rePATRN, a startup that aims to solve Ghana's plastic waste mismanagement issue by working with informal waste pickers. He is now fully dedicated to the growth of rePATRN.

REPATR: LEVERAGING THE INFORMAL ECONOMY TO RECYCLE PLASTIC

In Ghana, the combination of a rapidly growing population and an increasing affluence led to a dramatic rise in waste volumes. Plastic, and especially plastic bottle waste, is among the biggest challenge in the country. Informal waste pickers collect plastic, among other valuable materials, but the country lacks enforcement of waste management policies and adequate infrastructure to manage it. The idea of rePATRN as a recycling company started from an observation: apart from one company based in South Africa, no one was offering a service to recycle PET plastic at industrial scale, despite its wide use. rePATRN's ultimate purpose is to create the capacity to recycle PET plastic in large volumes, while leveraging the informal sector.

rePATRN's value chain works as follows: rePATRN's head of procurement, a former waste picker who knows exactly how things work in the field, recruits informal waste pickers. The latter add PET bottles to the materials they already collect – thus, their daily task is not fundamentally altered. They pass on the bottles to a trader, who delivers (by truck) the plastic to a production facility. Caps and other impurities are removed, plastic bottles are sorted by color and compressed into bales. The bales are then sold on to recycling companies abroad, and thus reintroduced into the supply chain. rePATRN's pilot was launched in 2015 in the port city of Tema, located 35 km from Accra. The objective was to prove that a significant amount of plastic could be collected. Between 2015 and 2020, rePATRN moved from collecting 10 to 20 metric tons of plastic every other month to 900 metric tons monthly.

rePATRN wants to have environmental, financial and social impacts. The removal and processing of PET bottles has a massive positive impact on the environment.

WORKING WITH THE INFORMAL SECTOR: LESSONS LEARNED FROM REPATR'S EXPERIENCE

Including informal workers in the supply chain can be challenging for companies. Beyond best practices, working with informal workers requires adopting a specific mindset, and understanding informal workers' day-to-day activities and drivers.

- **Understanding informal workers' habits is prerequisite.** Many individuals, entrepreneurs and companies suffer from a major "savior's complex" when they look at the informal sector. But working with the informal sector should not mean imposing your own views. It rather means focusing on improving existing structures and behaviors. To efficiently engage informal workers in the long run, entrepreneurs need to consider the wealth of knowledge in local communities and work in their best interest. Co-creation with informal workers is a must for building efficient models.



©Natalija Gormalova

- A different time horizon. Most informal workers live their daily life on “survival mode,” and do not make plans or investments for the future – they cannot afford to. Engaging them by referring to long-term advantages or consequences probably won’t be relevant. Instead, informal workers tend to care about concrete, immediate improvements to their daily lives.
- Acknowledging informal workers’ rationality. On landfill sites, rePATRN teams noticed that waste pickers were not used to removing the cap when they collected plastic bottles – even though it could allow them to sell their plastic at a higher price. It first appeared irrational. Truth is, it requires them to put in an extra effort, and the cost-to-benefit ratio is not high enough to justify such a change.
- The importance of incentive mechanisms. Several “soft factors” and incentives also enter into account to guarantee informal workers’ loyalty. As an example, rePATRN often provides drivers with snacks: they know that they are appreciated and well treated and will be eager to keep working together in the future. This point is essential to building trust – even more so as companies sometimes take advantage of informal workers’ vulnerability.

Between 2015 and 2020, rePATRN moved from collecting 10 to 20 metric tons of plastic every other month to 900 metric tons monthly – to the point that the company had to tell waste pickers to slow down

PLANS FOR THE FUTURE

Five years after its creation, rePATRN has shown that its network of informal waste pickers is able to collect large volumes of plastic – to the point that the company had to tell collectors to slow down. Having demonstrated that it would be relevant and economically profitable to build PET recycling infrastructures in Ghana – since demand is strong – rePATRN now aims to move to the next step and initial goal: recycling. The company wants to strengthen its partnership with Veolia to address the PET challenges in Ghana together. Beyond strategic orientations, rePATRN also wants to improve the transparency and efficiency of payment transactions within its value chain. Currently, the trader is paid by the recycler at the facility, and then pays the picker. There is a delay between the two payments, which tends to increase the existing mistrust between pickers and traders – to keep the cash, traders sometimes tell pickers that the company does not pay them, which is not true. rePATRN would like to implement SAP electronic payments. Based on mobile money, this system is entirely transparent and could allow pickers to be informed in real time as soon as the trader is paid – and how much he has been paid. Finally, rePATRN also wants to adopt a fair-trade model in cooperation with fashion brands – its indirect clients. Indeed, several brands value rePATRN’s story: using recycled and traceable plastic – with a positive environmental and social impact – in their products and packaging allows them to add a mark-up to their prices, which could then be returned, as a bonus, to the waste picker. This could be a tool to go a step further in engaging informal waste pickers and bringing them added value.

UNLOCKING THE CIRCULAR ECONOMY POTENTIAL TO TACKLE THE SANITATION CHALLENGE

Louise Couder,
Director of External Relations,
Sanergy

Sheila Kibuthu,
Communications Manager,
Sanergy



We serve over 130,000 urban residents with safe sanitation every single day - ©Sanergy

Louise Couder is Sanergy's director of external relations. She oversees relationships with stakeholders including donors, investors, public authorities, and media. She has more than 7 years' experience in project management and fundraising within Sanergy and the NGO *Première Urgence Internationale*. She holds a master's degree in Development Studies from University of Paris I: Panthéon-Sorbonne.

Sheila Kibuthu supervises Sanergy's communications, she oversees building relationships with media to promote Sanergy's brand and contributes to the essential advocacy work with local governments. She holds a bachelor's degree in Communications and Public Relations from Daystar University.

Most of the African countries are far from reaching the Sustainable Development Goal 6.2 aiming at achieving access to proper sanitation for all by 2030. Diseases related to poor sanitation, such as diarrhoea, cause thousands of preventable deaths, hamper productivity, education, and economic growth.

Sanergy has developed and runs a comprehensive model based on container-based sanitation and circular economy in Nairobi's slums. Sanergy has three main activities: (1) fabrication and installation of toilet units serving more than 130,000 people every day, (2) treatment of urban organic waste – kitchen, agricultural, market and faecal waste (12,000 tons of waste removed in 2019) and (3) commercialization of valuable end-products for the agricultural sector. Cracking the case was a hardship but working hands in hands with the local government and the communities enabled to create mutually beneficial collaborations. Sanergy proved that container-based sanitation (CBS) are adapted to slums. Achieving financial balance will require scaling up the operational model in order to collect enough raw material. This scalability challenge, in addition to the investment required to build strong relationships with local authorities, may explain why CBS solutions are not yet a widespread solution in African slums. The advocacy work carried out by Sanergy and other key players involved in the Container-Based Sanitation Alliance (CBSA) is aiming to accelerate these innovative solutions.

INTRODUCTION

Around the world, 2.3 billion people live without access to basic sanitation services. Almost 900 million of these people practice open defecation¹. Poor sanitation is the cause of multiple diseases (cholera, diarrhoea, dysentery, hepatitis A) as well as a multitude of social issues (anxiety, indignity, risk of sexual assault, loss of time). The problem is responsible for a global loss of \$260 billion annually². Finding solutions could help prevent more than 2 million deaths per year, most of them children³. In African countries, with a fast-growing population and limited government resources, responding to the sanitation urgent need is a vital challenge.

Sanitation has become a priority for the Kenyan government, but the lack of financial resources hinders sewerage projects. In Nairobi, two-thirds of citizens suffer from lack of access to sanitation services, as most of the urban slums are not connected to a sewer⁴. Sanergy is offering an innovative value proposition, built on a container-based toilet network and circular economy, to contribute to solving the sanitation challenge.

¹ World Bank, 2015

² WHO, "Global costs and benefits of drinking-water supply and sanitation interventions to reach the MDG target and universal coverage", 2012

³ UN, "Clean Water and Sanitation: Why it matters", 2016

⁴ Cathy Watson, "Thirsty city: after months of water rationing Nairobi may run dry," *The Guardian*, July 24, 2017

THE SANITATION CHALLENGE IN AFRICA

WHY SANITATION MATTERS

Sustainable Development Goal #6.2 aims at achieving access to adequate and equitable sanitation and hygiene for all and put an end to open defecation by 2030. Despite significant progress since 1990 – over 2.2 billion people gained access to improved toilets – almost one on every three people in the world lives without proper access to sanitation⁵. In 2010, significant progress was achieved in Kenya when sanitation became a constitutional right. Article 43 of the Constitution provides that every person has the right “to reasonable standards of sanitation”. The Kenyan government has a strong ambition to eradicate open defecation by 2030 and the KESHP (Kenya Environmental Sanitation and Hygiene Policy), developed by its Ministry of Health department has already made progress in combating unsafe sanitation. Despite this political ambition, investments are not enough to reach the target: the government of Kenya spends only \$3 per person per year for the official sewerage system whereas \$54 would be necessary to serve everyone in the city⁶. Moreover, the population growth rate of Nairobi, almost 4% per year, urges the city to find other solutions, less expensive, more flexible, and faster to be deployed. On top of that, Nairobi is facing very frequent water crises, as the demand for its fast-growing population exceeds the supply capacity of its infrastructure (local dam, transfer canals, tunnels).

The benefits of a transition to safe sanitation for all are multiple. First, sanitation enables major health improvements, through a reduced number of diseases and improved nutrition. Diarrhoea is the 2nd mortality cause for children under 5. When it is not mortal, it causes stunting due to poor nutrition⁷. Second, the lack of sanitation hinders economic growth. Poor sanitation leads to gigantic losses, amounting to the equivalent of 6.4% of GDP in India (2006), 7.2% of GDP in Cambodia (2005) and 2.4% of GDP in Niger (2012)⁸. Premature deaths, health care treatment costs, loss of productivity, and loss of time are the main explanations of this cost. Moreover, improper disposal, and treatment of wastewater and faecal sludge seriously pollute the ecosystems. Human excreta are a burden for most countries, even though it could be turned into a profitable resource (fertilizer, energy, water, etc.).

Almost one out of every three people in the world lives without proper access to sanitation

POOR SOLUTIONS OFFERED TO CITY DWELLERS IN MOST INFORMAL SETTLEMENTS

Sewerage will not be feasible in every city, especially in the short-term. It requires billions of dollars and governments have often other priorities. Geography is also complex in urban slum areas which further hinders the development of these solutions.

When there is no sewerage to ensure individual equipment with safe and private toilets, residents are left with 4 options: (1) pay-per-use community pit latrine, expensive and in poor conditions, (2) plot toilets (shared between 10 to 50 households living in the same compound), pit latrines often in terrible conditions because they require regular maintenance, which is not always easily accessible (3) “flying toilets” (i.e. pooping into a plastic bag and throwing it as far away as possible), which has a detrimental impact on the living environment and (4) open defecation in open areas such as dumping yard, riverbanks, along railways, etc. An estimated 66% of the excreta is unsafely managed in Nairobi⁹, polluting most rivers and canals. These

alternative solutions are risky for users as most of them are unhygienic and have an impact on health and the environment.

THE ROLE OF THE PRIVATE SECTOR IN IMPROVING ALTERNATIVE SOLUTIONS

In this situation, container-based sanitation, which consists of collecting human excreta in removable containers then transported to treatment facilities, appears to be a promising solution adapted to these areas. The KESHP recognized this solution as an equally efficient sanitation alternative in 2016. By doing so they acknowledge the role of the private sector in improving alternative to sewerage and solutions like the one developed by Sanergy.

Still tackling the sanitation challenge is complex. Beyond infrastructure and technologies, governments and the private sector should remember that ensuring a transition to safe sanitation for all also required behaviour change approaches. Many different sociological, economic, and cultural factors influence sanitation-related decisions and must be considered to ensure new sanitation infrastructures are adopted and used daily. If not carefully considered, these factors can deter people from using safe sanitation options, even when they are available.

5 World Bank, 2015

6 Sanergy, internal study, 2018

7 WHO, 2017

8 World Bank, Water and Sanitation Program, 2012

9 APHRC, Sanergy, NCCG, NWSC, Nairobi's Shit Flow Diagram



Sanergy has installed over 3,500 Fresh Life Toilets across 11 informal settlements in Nairobi - ©Sanergy

SANERGY'S SOLUTION: UNLOCKING THE POTENTIAL OF THE CIRCULAR ECONOMY

A SIMPLE STARTING POINT: TURNING S*** INTO GOLD

Sanergy was founded in 2009 by 3 MIT students (David Auerbach, Lindsay Stradley, and Ani Vallabhaneni) with the ambition to tackle the sanitation crisis in the developing world. The original idea was to turn human waste into biogas because energy generation seemed particularly promising for the MIT students and responded to local demand. The company name, Sanergy, was created at that time, as a combination of "sanitation" and "energy". Six months after the launch, the co-founders realized that biogas production was not profitable without an enormous amount of faeces to treat. Given the difficulty in scaling up the collection, they decided to pivot to something with a faster return on investment. Fertilizer seemed to be the most promising product. The transformation process was mainly a well-proven natural process of decomposition, much easier to master than biogas production. Since then, Sanergy has expanded its range of products (insect-based animal feed, biomass briquettes for combustion) and has continuously been working on new product development.

Sanergy has developed a circular economy model in which value is created for different stakeholders at each step of the cycle: the waste of the ones become the resource of the others

A FULL-VALUE CHAIN APPROACH

Sanergy has developed a cyclic model in which the company creates value for different stakeholders at each step of the cycle. The waste and burden of the ones become the resource and opportunity of the others. The large number of stakeholders involved in the cycle represents a strength and a challenge at the same time. Circular sanitation business models evolve in an ecosystem composed of entrepreneurs, waste operators, small and large businesses, municipalities, and foreign donors.

Sanergy's activity can be divided into 3 workstreams: providing access to infrastructure while creating economic opportunities for local communities, safely collecting sanitation waste and finally turning waste into valuable products, especially for farmers.

PROVIDING ACCESS TO SAFE AND AFFORDABLE FACILITIES WHILE BRINGING ECONOMIC OPPORTUNITIES TO SLUM-DWELLERS

The first workstream consists of developing a network of toilets in Nairobi's slums. Today Sanergy has 3,500 active toilets serving more than 130,000 people per day across 11 informal settlements, with a 13% penetration rate in its operating regions. These toilets are low-cost, high-quality container-based latrines branded as Fresh Life Toilets (FLT). Sanergy franchises these toilets to local entrepreneurs (currently working with over 2,000 entrepreneurs), called Fresh Life Operators (FLOs), who charge the users with a small fee.



Sanergy's logistics staff regularly removes waste from the community safely and professionally - ©Sanergy

Sanergy deploys toilets for different types of users: residents (B2C) and residence and community institutions (B2B).

- On the B2B side, Sanergy's residential franchise model represents 76% of the network. They provide toilets to landlords managing residences and community institutions such as schools, clinics, or churches. For landlords, installing an FLT is a way to increase the value of the rental property and to satisfy the tenants. They do not have any upfront investment for the installation of the FLT, and only pay a monthly fee for service of \$8.50 per toilet for all the support services (regular waste collection, maintenance, customer support).
- On the B2C side, Sanergy franchises FLT to community members (FLOs) who run the toilet as pay-per-use toilets in public areas, overseeing the promotion and daily cleaning of the toilets. On the first year of their franchise agreement, the entrepreneurs buy the toilet for \$270 (and have access to a zero interest loan provided by Sanergy) and they pay a franchise annual fee of \$70 for all the support services (regular waste collection, maintenance, customer support) ensured by Sanergy's employees. FLOs are encouraged to follow market price to charge users: usually KSh5 (\$0.05) per use. The revenue generated by FLOs can reach \$1,000 per year. The model is therefore attractive and led to an important rise in the number of franchise demands in neighbourhoods that are highly impacted by unemployment (40% of unemployment in most Kenyan slums¹⁰).

FLOs in both franchise types receive a kit (hand-washing stand, soap, mop and cleaning bucket, safety gloves and boots) and must provide saw dust, tissue, water and soap for users.

ENSURING DECENTRALIZED WASTE COLLECTION WITH WELL-TRAINED COLLECTORS

Sanergy also ensures faecal waste collection from FLT to their Organics Recycling Factory. It is a huge operational challenge: more than three thousand FLT units spread across the tight and tangled streets of Nairobi's slums must be emptied on a very frequent basis. Sanergy has 100 waste collectors trained to carefully clear the waste every day. They use manual handcarts to transport the sealed barrels of waste out of slums and then load them onto trucks for transportation to treatment and processing plant, located in the outskirts of the city.

This is a crucial step. If the emptying and cleaning are not properly done, the users will not use the service anymore, and they will spread the word very quickly. On the contrary, well-maintained toilets will naturally attract more and more users and franchisees.

Unlike the other workers who traditionally empty the slums' latrine pits in dire conditions, Fresh Life's waste collectors are trained and benefit from health insurance, employment contract, full personal protection equipment, and vaccination to protect them against waste-borne diseases.

Most of them are community members who know all too well the existing sanitation challenges in their communities. They are well respected for their contribution of making a difference by cleaning up their communities.

¹⁰ UN Development Programme, "Human Development Report 2016: Human Development for Everyone"



1,000+ farmers use Sanergy's agricultural inputs and have seen a 30% increase in their yields - @Sanergy

DISTRIBUTING AGRICULTURAL END-PRODUCTS MADE FROM SANITATION WASTE

Once delivered in the recycling facilities, the waste is treated and converted into 3 different products: organic fertilizer, protein for animal feed and energy briquettes.

The first product is a nutrient-rich organic fertilizer aiming at improving Kenyan farmers' soil health and boosting their yields. Most of the clients are medium to smallholders' farmers. The fertilizer is made of urban sanitation waste as well as other organic waste. Sanergy processes the faecal waste to eliminate any pathogens. One of the main advantages is to reduce the farmers' dependence on imported chemical fertilizers. Sanergy's product improves soil health by adding organic matter and is proved to ensure better crop yields (30% increase) in the long term, making it a more profitable input. The waste is also turned into protein for animal feed. The process involves rearing Black Soldier fly larvae, an insect that will naturally and very efficiently convert the waste into a safe animal feed. Customers reported a 30% increase in yields because of using the high-protein feed. The product is a sustainable alternative for common fishmeal used for chicken and pig farming, which has led to overfishing and ecosystem destruction in the Lake Victoria region. Sanergy has also developed energy briquettes for industrial use, made from organic and sanitation waste. Produced locally, these briquettes limit Kenya's dependence on fossil fuels.

Many of the industrial processes mentioned above require considerable quantities of waste to be profitable. The challenge is to scale the amount of waste collected – both

sanitation waste from the network of Fresh Life Toilets and from collection of organic waste fast enough to provide enough waste to treat.

KEY SUCCESS FACTORS TO DEVELOP SANITATION SOLUTION IN AFRICAN SLUMS

ENABLING ENVIRONMENT AND RELATIONSHIPS WITH LOCAL AUTHORITIES

Nairobi has been a major entrepreneurial hub in East Africa for more than 10 years. Some social entrepreneurs have already known great success, such as solar energy provider M-Kopa and agriculture NGO One Acre Fund. This enabling environment has created a real dynamic and collaborative environment from which startups, including Sanergy, benefit.

Beyond a dynamic and innovative private sector, the role of the public sector is also essential to develop new solutions in the sanitation sector. Sanergy needs authorizations from public authorities to run its activities and install FLT in informal settlements, collect all the waste generated as well as safety guaranties and authorization to sell agricultural inputs. Sanergy has a dedicated team whose role is to work with local government to adjust policies and regulations, obtain labels and business licenses to operate, and secure land access for FLT and waste processing facilities. This is a key challenge to enter new markets outside Kenya. Sanergy has launched an advisory

service named Citywise. Citywise helps sanitation actors, mainly municipalities, to assess the needs and helps them to develop CBS solutions. They are currently working with Kisumu in Kenya and Bukavu in Democratic Republic of Congo.

BRAND AWARENESS AND REPUTATION

Brand awareness has been key in Sanergy's expansion with the challenge to build a credible brand that communities want to invest in. Right from its early days, Sanergy used a problem-led approach, rather than a solutions-led approach to address the existing sanitation gap. Communities expressed their discontent with unhygienic norms of their sanitation landscape: flying toilets and unsanitary pit latrines which polluted their environment and harmed their health. Out of their desire for a fresh start and an improvement in their life towards hygienic sanitation, Sanergy's brand 'Fresh Life' was borne. Sanergy then put a heavy emphasis on intensive grassroots engagement in the local community to build their brand. Continually shining a spotlight on its customer: the slum residents who generously shared their experiences, needs, and aspirations for building healthy, robust communities in what was a fragmented sanitation ecosystem. At the same time, Sanergy built a marketing team which conducted focus group meetings and planned edutainment events. These events attracted crowds of hundreds of people, with whom Fresh Life engaged in conversations about health education and the priceless benefits of safe sanitation habits, like toilet usage, handwashing, and making sure waste safely leaves the community. They missioned hip-hop songs to play on local radio and broadcast a catchy motto that the children would remember and sing at home. Neighbourhood block parties were organized to celebrate the opening of toilets and introduce the concept of Fresh Life Toilets. Even the toilets themselves were designed to spread brand awareness: bright blue-painted walls featured with a colourful Fresh Life logo contrasting with the drab colours of the slums. Ultimately, Fresh Life gained an understanding of the community context and had the chance to market its initial product and services centered around a franchise model that simultaneously promoted public health and economic empowerment.

BEHAVIOUR CHANGE

Sanergy has put a lot of efforts to trigger behaviour change in the different steps of their activity. A dedicated sales team consisting of community members has been created. They are probably the most convincing voices to generate behaviour change. They use the existing relationships they have within the community to promote Sanergy's products and services. Business development and behaviour change also rely on FLOs and local leaders, who are particularly good ambassadors since they have invested and are involved in the project. WASH training is also dispensed in schools. Children are often excellent champions of behaviour change in their own family.

Peer-to-peer dissemination of information turned out to be the best way to promote behaviour change and to support the adoption of Sanergy's solution. The Fresh Life network had been built from within the community intentionally - from franchisees to the salespeople to the waste collectors: people who grew up in and thus knew the informal settlements. All of these people had a personal connection to Sanergy's mission, and therefore could easily take ownership and convey the value of hygienic sanitation to the rest of the community. To complement their local expertise, Fresh Life provides regular training and ongoing operational support, setting clear expectations to the local entrepreneurs as they have their toilet business up and running. In the last phase of Sanergy's cycle, behaviour change is also key. Farm Star products are radically innovative for many farmers and using agricultural inputs made of human waste can be perceived as risky by potential customers. To capture market shares, Sanergy relies on the influence of lead farmers that have tested and approved Farm Star products. The peer-to-peer recommendation is, here again, essential for behaviour change. It builds trust and reinsures on the performances of the products on the farmers' yields.

CONCLUSION

Full coverage of African urban areas with sewer systems will be difficult to achieve given the pace of urbanization, the cost, and technicity required to install such an infrastructure. In a nutshell, the world cannot wait for sewers. Solutions like the ones developed by Sanergy are effective solutions to answer an urgent need.

CBS solutions are safe, waterwise, and affordable, which sounds promising for the continent. More and more private players are testing such solutions in various geographies: Clean Team in Ghana, Loowatt in Madagascar, x-runner in Peru, SOIL in Haiti, etc. As these solutions bring safe sanitation for slum residents with up to 95% less money than traditional sewerage systems, it can be qualified as a leapfrog innovation. Even if these solutions are market-ready, they lack confident investors and support from public authorities.

To accelerate the adoption and the scale-up of these solutions, a coalition of sanipreneurs named Container-Based Sanitation Alliance (CBSA) promotes knowledge sharing and learning, enhances legitimacy by creating a set of common CBS guidelines and standards. The Toilet Board Coalition, a global business-led partnership also has the ambition to accelerate CBS economy, with research programs, accelerator programs for sanitation entrepreneurs, and by connecting private, public, and non-profit sectors. These coalitions believe there is an opportunity for CBS enterprises to collaborate in an effective way to achieve sector-wide acceptance and endorsement, reach scale, and create sustainable impact.

SMART METERS: INNOVATING TO IMPROVE WATER SUPPLY IN A POST- COVID CONTEXT

Sam Drabble

Head of Evaluation,
Research & Learning at WSUP

Rosemary Campbell

Head of Water at WSUP

Philip Oyamo

Senior Project Manager at WSUP

Rosie Renouf

Research & Policy Manager at WSUP



Demonstration of smart meter installation - ©UNTAPPED

Sam Drabble leads programme learning for Water & Sanitation for the Urban Poor (WSUP), a not-for-profit company that helps transform cities to benefit the millions who lack access to water and sanitation. He has a background in evaluation, research and learning, having previously worked as analyst specialising in programme evaluation at RAND Europe.

Rosemary Campbell is Head of Water with WSUP's Innovation and Consumer Needs team. She has 28 years of experience from the water industry, including 20 years at Veolia Water and Mott MacDonald with a variety of executive roles.

Philip Oyamo has been leading WSUP's interventions in Mombasa and Malindi, Kenya, since 2013. He has extensive experience in institutional pro-poor capacity set-up and support, brokering city-wide agreements intended to improve access to water and sanitation for the base of pyramid consumers.

Rosie Renouf is WSUP's Research & Policy Manager, leading on research-into-policy activities and supporting research management across the organization.

In cities across Africa, rapidly expanding low-income communities (LICs) pose unique technical and social challenges to utilities in expanding services – but they also present an opportunity to expand the customer base and generate revenues. COVID-19 is placing huge additional pressures on the financial viability of utilities, exacerbating the need for innovative service delivery models to this segment of the customer base. In the context of short and long-term challenges posed by COVID-19, water utilities must take every measure available to improve the efficiency of operations: service quality and attention to the customer will be even more important; greater control will be required over the distribution network; and billing and revenues will need to be maximized to support the bottom line.

Smart Water Meters are a new technology with the potential to assist utilities in this process of transformation. The model offers greater control for the customer, through a flexible prepayment tailored to the spending habits of low-income households; and greater control for the utility, enabling real-time data on water demand across the supply area, and supporting a shift from reactive firefighting to preventative planning. Pilots of the technology to date have produced good results; however, more testing is needed, particularly in LICs. One project expected to inform the evidence base is a pilot of 500 smart meters recently underway in Watamu, in the Kenyan district of Malindi.

INTRODUCTION

COVID-19 is placing huge stress on the operations of water utilities across Africa. Regular handwashing with soap is a key measure in combating the virus, but to sustain this practice, people must have access to a regular water supply. Innovation is urgently required to enable utilities to better manage their systems in a context of limited finances and evolving customer needs.

This article introduces Smart Meters – a new technology with the potential to improve both low-income customer satisfaction and the utility bottom line. Customers connected to Smart Meters have access to a flexible prepayment model, providing them with greater control over their account; while the utility gains access to real-time data and greater control over supply. Although more work is needed to test the technology in the specific context of service provision to low-income communities, Smart Meters could have a valuable role to play as one part of a sustainable long-term response to the crisis.



MAWASCO staff retrieve mechanical meters from the pilot area - ©UNTAPPED

THE CHALLENGE OF SERVING LOW-INCOME COMMUNITIES

Water utilities are typically mandated to serve everyone in their catchment area. In cities across Africa, this includes low-income communities (LICs), many of which have rapidly expanded in recent years. These communities are often characterised by poor-quality housing, insecure tenure and high population densities; by subsistence living and low incomes; and by low levels of access to basic services. As such, LICs can pose unique technical and social challenges to utilities in expanding services; these challenges increase the need for innovative, context-specific approaches, to ensure all LIC residents have access to a safe, reliable and affordable water supply. However, in WSUP's view, service extension to LICs must also be understood as an opportunity. Providing a formal service to these households creates a 'win-win' situation: low-income consumers benefit from a cheaper, more reliable utility supply, while the utility generates additional revenue from all these new customers.

Water utilities are on the front line of the battle against COVID-19. Without access to a safe and reliable water supply, individuals cannot practice the handwashing behaviours required to reduce transmission rates

THE IMPLICATIONS OF COVID-19 FOR UNIVERSAL SERVICE PROVISION

Water utilities are on the front line of the battle against COVID-19. Without access to a safe and reliable water supply, individuals cannot practice the handwashing behaviours required to reduce transmission rates. As a result, the pandemic has increased political attention to water supply — but it has also placed unique pressures on the financial viability of water utilities. In Kenya for example, utilities have been tasked by the government to provide services to informal settlements free of charge, leading to drops in revenue collection as high as 50%. It remains uncertain if utilities will receive future government support to help cover these losses, and there are real concerns that providing free water could undermine long-term willingness to pay for formal services.

In many countries, utilities will need financial support in the near term if they are to maintain current levels of service. The financial strain created by COVID-19 also increases the need for strategies to support long-term utility resilience. In order to place services on a sustainable footing, utilities will

need to adopt a holistic approach to strengthen all aspects of core operations. This includes financial management, but also critical business areas such as governance, staff capacity and customer engagement (Box).

CUSTOMERS AT THE CENTRE



UNTAPPED staff inspecting new smart meters in the pilot area - ©UNTAPPED

For a utility to provide all customers with continuous, safe water, innovative solutions are required – particularly in LICs. Technical inputs and technological products are significant components of improving a service, but they must be integrated into an organisational approach that is focused on the expectations of the customer. WSUP works with utilities to ensure that customers are advocates, not adversaries. For that to happen, customers must be at the centre of everything a utility does, from staff training to procurement to communications. This includes the introduction of new technologies such as Smart Meters, explored overleaf.

INTRODUCING SMART METERS: AN INNOVATIVE SOLUTION FOR SERVING LICs

In WSUP's view, the pressures on utility operations created by COVID-19 exacerbate the already urgent need for innovative solutions to improve service levels, increase customer retention, lock-in revenues, and provide utilities with greater control over water supply.

This latter point around control is critically important. For example, many utilities still use a single meter to collect information on water supply and flow in a service area.

These meters are not sufficient to provide a granular picture of the service experienced by each customer at the household level, or to collect vital information about ongoing water location, pressure and flow: utilities monitor what water goes into an area and what is used by a customer, and very little else. This data gap contributes to a range of issues, including delays in the identification, isolation and resolution of leakages where they occur, leading to increased Non Revenue Water (water that enters the distribution system which is then lost or unaccounted for) and service disruptions for the customer.

Smart Meters are a new technology with the potential to mitigate these issues. The Smart Meters sit within the wider water supply system, connected to a communication network, and supported by software packages so data can be received and analysed centrally. This enables the utility to collect more detailed data, both about how water moves within the service area and how it is consumed at the household level. Potential advantages of Smart Meters for both customers and the utility include:

Improved customer satisfaction: Customers connected to Smart Meters have access to a flexible prepayment model, providing them with greater control over their account. This enables customers to top up their accounts in small amounts by mobile phone, with customers then debited according to their water usage. This model is well-adapted to the spending habits of low-income households, who prefer “little-and-often” payments to less frequent and higher billing.

Improved utility operations: Smart Meters can be accessed remotely, in comparison to standard meters which require manual reading. This can vastly reduce inaccurate meter readings through human error. But more significantly, staff



MAWASCO staff oversee commissioning of smart meters - ©UNTAPPED

time and resource previously spent on manually reading meters and collecting small payments from households can be redeployed: meter reader staff can still provide a vital direct point of contact with customers, but can focus more on customer care and communication about water consumption, payment, small-scale leakage repair, identifying illegal connections to the network and making new connections. Meanwhile, customer care staff based within the utility can pivot to resolving more complicated, in-depth issues with the system, rather than day-to-day customer care and complaint resolution.

Preventative planning: Smart Meters allow the utility to see the status of the whole water supply area at any given moment. This real-time mapping supports utilities to shift from reactive firefighting to preventative planning: better knowledge about water demand per area reduces the risk of inconsistent water pressure and protects the network from degradation. This in turn mitigates the risk of contamination, improves water quality at the point of supply, and prevents air blockages that disrupt meter readings. If and when leaks and water pressure drops do occur, they can be detected immediately before customers experience prolonged service disruption.

NEXT STEPS: PILOT PROJECT IN MALINDI

At the global level, Smart Meters are increasingly viewed as critical for utility efforts to track water usage and identify waste and leakage: a recent report estimated the drive for the digitalization of water utilities' distribution network will result in an installed base of 400 million smart water meters worldwide by 2026.¹ Although the context in which utilities operate will vary significantly by region, and many African utilities will face a specific set of challenges, WSUP believes the potential of Smart Meters to support African utilities is also clear. The technology has already been used by our partner utility Nairobi City Water & Sewerage Company (NCWSC) in relation to major customers, resulting in improved billing and revenue collection; another partner utility, Nakuru Water and Sanitation Services Company (NAWASSCO), are adopting a phased approach to introducing the technology. A recent pilot of CTSuite – a smart and prepaid water meter and software developed by CityTaps – in Niamey, Niger, demonstrated improved customer repayment and high levels of customer satisfaction with the technology and service delivery model.²

Nonetheless, more work is needed to test the technology, particularly in the context of improving services to LICs. An exciting new project involves the installation of 500 Smart



Configuration of smart meter communication antennae - ©UNTAPPED

Meters in Watamu, in the Kenyan district of Malindi. The project is a partnership between Malindi Water & Sewerage Company (MAWASCO), WSUP, CITYTAPS (a water solution provider producing PAYGO smart water meters), and UNTAPPED, a water finance, technology and consulting company providing financing and support to water utilities. Co-financed by a grant from the French Ministry of Finance and by a lease agreement from UNTAPPED, the pilot is centrally aimed at improving the efficiency of billing and revenue collection and reducing Non Revenue Water. Importantly, the pilot will target low-income customers, who can use their PAYGO smart meters to top-up small amounts on their account. MAWASCO will have access to detailed dashboards via an online cloud platform, to analyze water consumption and payment collection in real time at a global level and on a per customer basis. The 18-month pilot began in July 2020, with results expected to be available from November 2020, subject to continued easing of COVID restrictions.

CONCLUSION

In the context of short and long-term challenges posed by COVID-19, water utilities must take every measure available to improve the efficiency of operations. Service quality and attention to the customer will be even more important – many low-income households are now accustomed to getting their water for free, and their continued custom cannot be taken for granted. Similarly, financial performance must be maximised to support the bottom line: that means improved billing and revenue collection and reduced Non Revenue Water. Although only one part of the organisation-wide response required by utilities, innovations like Smart Meters could play an important role in navigating the crisis.

1 <https://www.abiresearch.com/press/400-million-smart-water-meters-be-installed-worldwide-2026-scalable-meter-data-management-crucial/>

2 CityTaps (2019) CityTaps Pilot in Niamey, Niger – Conclusions. Available at: https://uploads.strikinglycdn.com/files/61fe0e7e-2baf-426a-9e2a-1e7f96a5322a/Impact_Report_2019_Final_UK.pdf

3. CONDITIONS NEEDED FOR SCALING UP SUCCESSFULLY



There are a number of pitfalls to avoid when talking about innovation. First is not embracing an overly romanticized vision of bottom-up innovations. Then there is the risk of blithely embracing technophilia. Many initiatives remain small scale and might never have the reach needed to overcome the challenges of accessing essential services across Africa. There are a number of seemingly vital success conditions to meet if innovative solutions for accessing services are to see lasting improvement.

DIVERSIFY SOURCES OF FINANCING

In recent years, in a context of economic growth in Africa, national governments have played an important part in financing infrastructure. But sadly, the amounts committed remained greatly insufficient. Overcoming the shortfall in public financing will require encouraging private investment and revisions to mechanisms used for covering and sharing risk. Processes under way in the off-grid energy sector are particularly interesting, recalls Jean-Michel Severino. Increasing the role of private investment does not mean that states should withdraw. Indeed, governments must remain key stakeholders to ensure that all services, including the less profitable, operate correctly.

ENCOURAGE COALITIONS

Governance of essential services suffers from excessive fragmentation and is often answerable to several centralized bodies. The must is to opt for decentralized decision-making so action can be taken at the most appropriate level. Multi-stakeholders' approaches, similar to the Toilet Board Coalition model presented in this issue by Erin McCusker, are also worth developing. Lastly, governance requires more focus on, and involvement by, users when designing services. This is essential if innovations are to be accepted.

ADOPT A USER-CENTERED APPROACH

Users are at the heart of services. No matter how innovative a newly built infrastructure may be, this is not in itself enough to generate uptake for new types of essential services. The user or customer experience is fundamental to overcoming barriers to uptake. The multi-country study run by Firmenich and Archipel&Co on behalf of the Bill & Melinda Gates Foundation, presented here by Bérangère Magarinos-Ruchats and Maureen Ravily, shows how users are very unlikely to switch to toilets

instead of practices such as open-air defecation when they have unsatisfactory experiences using toilets. Innovative solutions have to be known and understood by the populations if they are to be adopted. Awareness-raising and education of users and consumers is a cornerstone for ensuring successful uptake. Modern awareness campaigns are very different, and are becoming far more interactive thanks to the reach of digital and social media. But they must also reach out to groups who lack online connectivity or live in remote settings. Gordon Achola, Nana Asamoah-Manu, Andrea Weiss and Younès Drici Tani take a look at examples of campaigns and best practices covering all four services. Lastly, user-centered approaches also rely on choosing the right technical and technological solutions. Experience shows that when trying to convince people to adopt new solutions, particularly the digital ones presented here by George Bauer, it is better to build on existing habits rather than trying to create new ones.

ASSESS THE ECONOMIC, SOCIAL AND ENVIRONMENTAL IMPACTS OF THE SOLUTIONS

Impact assessments are, rightly, becoming central to rolling out any project. The complexity lies in being able to measure change and ascribe it to an action put in place. Several methodologies have been developed in recent years: randomization, control groups, before-after studies, and so on. Jean-Claude Berthelemy describes a triangulation approach used to analyze off-grid energy projects.

Mathilde Martin-Moreau
David Ménascé
Archipel&Co,
Issue coordinators

NEW MODELS FOR FINANCING ESSENTIAL SERVICES

Jean-Michel SEVERINO
CEO, Investisseurs & Partenaires



Jean-Michel Severino has spent his entire career in international development and its financing. He was previously Vice-President for East Asia at the World Bank (1996-2000) and Executive Director of AFD, the French Development Agency, from 2001 to 2010. Since 2011 he has been CEO of Investisseurs & Partenaires (I&P), an impact investing fund dedicated to supporting small and medium-size businesses in sub-Saharan Africa. He is a member of several investment committees and boards of funds allied with I&P (Phitrust Partenaires, Adenia Partners and Grameen Crédit Agricole) as well as several major corporates (Orange SA, Danone and Michelin).

In recent years, states across the African continent have increased their investments in the water, sanitation and energy sectors. However, the extent of the infrastructure remains well below the global average, and population growth in Africa will intensify demand for basic services. The question of financing these services – capital-intensive at first and only generating a return in the long term – is strategically important. With the emergence of decentralized systems, primarily in the energy sector, private actors such as businesses, foundations, impact investment funds, etc., have increasingly financed infrastructures that are alternatives and/or complementary to centralized services. Although a driver for progress and innovation, private financing can never fully meet the vast need for financing. It cannot replace public financing, particularly in low-profitability regions where households lack the means to pay for services and equipment. New mindsets and new forms of (de) regulation are needed to bring together all actors, public and private, international and domestic, to find ways to finance these services.

What have been the main sources of finance for water, sanitation and energy services in Africa in recent years?

Jean-Michel Severino: Quantitatively, in recent years state financing has been the most common instrument for financing water, sanitation and energy services. We are in a period where, until the coronavirus crisis struck, state budgets had risen considerably on the back of Africa's economic growth since the turn of the century. States were in a position to allocate major sums to building up their infrastructures, particularly in the water sector. Sadly, these sums remain insufficient to close the gap in terms of facilities available to African populations.

A not-inconsiderable portion of investments made by the poorest states was financed through public development aid in the form of donations, whereas states with sounder economies were able to either borrow from major multilateral and bilateral financial institutions or directly on international capital markets. Against this background, China has made a considerable contribution to financing, particularly major centralized energy installations. This is one of the main reasons for the explosion of the African sovereign debt over the past decade.

At the same time, although some major public-private partnership operations have been put in place, those were less common in the water and waste sectors than in energy and transportation.

The crucial innovation has been the rise of decentralized systems, notably in the energy sector. In energy, the overwhelming majority of financing was provided by private investors, whether from risk capital investment funds, foundations or even NGOs for the least profitable propositions. A major innovation saw for-profit and non-profit private capital join forces to develop decentralized markets. In the energy sector we have seen impact investors from Europe and the USA combining with major multinationals, working via their foundations or dedicated innovation programs and funds. This was especially prevalent in East Africa: the combination of good cellphone coverage and very dynamic actors on the ground genuinely transformed the situation in rural areas. This accounts for millions of rural households with access to energy thanks to decentralized systems, rolled out with very little in the way of public capital or subsidy.

A major innovation saw for-profit and non-profit private capital join forces to develop decentralized markets

You stress the growing role of private investment in the financing of essential services. Is there not a risk that private investors will only finance the most profitable services?

JMS: There is no doubt that there are two major limitations to the expansion of decentralized services and the growth in private financing.

The first limitation centers on serving the least well-off and least densely populated rural areas, places where it is very hard to run a profitable service. In these areas, state intervention in the form of subsidies is often indispensable, boosting the purchasing power of households that are generally very far from being able to afford basic equipment without assistance.

The second limitation is sectoral. If the energy and, to a lesser extent, waste sectors have witnessed the arrival of significant private investments, the water industry remains largely untouched by this process. Water is a highly capital-intensive industry that is institutionally very much dominated by public monopolies, including in rural areas. The presence of public actors, be these domestic or international, is also a very long-established tradition that has made it quite hard for new private initiatives to emerge. As a rule, the creditworthiness of the water sector remains far more challenging, and this applies to drinking

water as much as sanitation. Decentralized solutions are currently being tested in various places around the world, but they remain small scale and the viability of their economic models, when applied to Africa, remains unproven, although this is not to say they are definitely unfeasible.

Although a diversification of financing sources is desirable, nothing can replace taxation, which is a wellspring for subsidies and the allocation of public funds, in order to finance activities that cannot be financed by the private sector. For several decades to come, in many parts of Africa we are going to keep relying on a combination of public financing, from state budgets, and national operators able to work with public mandates to reach out to the poorest members of society and to sectors of the economy unable to attain financial equilibrium. States also have key roles to play as regulators. Take decentralized energy as an example. As soon as fixed tariffs are imposed, there has to be very close consultation between regulators, or the energy ministry if there is no independent regulator, and private actors in the field so that the correct balance can be found.



As CEO of a social impact investment fund, what is your approach to financing essential services?

JMS: First we need a bit of background. Essential services assets, energy assets in particular, have quickly become pretty expensive thanks to an influx of international risk capital, predominantly from the USA.

Investisseurs & Partenaires is a generalist investment fund that has already provided capital financing for several decentralized energy operations in poor countries such as Mauritania, Ghana, and across the Sahel region. The main criteria we use when selecting investments is a viable economic model combined with major impacts for the project's stakeholders. We always start by looking at impacts when assessing the relevance and eligibility of an investment, but we also look very closely at the conditions needed for profitability. This is because in recent years we have seen a lot of financially unsustainable projects rolled out in the essential services sector. This ultimately leads to failure and the disappearance of the impact hoped for. Venture capital approaches closely inspired by the digital economy often dominated: valuations were initially made on the basis of the number of connections or the speed that service points were rolled out, but without ever taking questions of financial equilibrium into account.

The conditions needed to attain profitability inevitably raise the issue of accessibility. If products are developed that are structurally too expensive, people will be unable to afford them. When looking at how business models are constructed, the two components we keep a constant watch on are households' ability to pay and the product's profitability.

Here I want to mention two examples from among the companies I&P has invested in, companies that offer valuable lessons for the sector.

The first is PEG Africa, a company we supported almost from the beginning. During our time working with the company we came to understand just how complicated it is to run a profitable access-to-energy service if you rely only on selling energy. It became clear that energy access had to be bundled with other products, such as audio, video and internet television services. The PEG story is a remarkable one, demonstrating the viability of its business model and proving itself able to control the multiple aspects of what is a highly complex industry. PEG is now selling beyond Ghana, in Côte d'Ivoire, Senegal and other countries in the region.

The second project that comes to mind is CDS, a company offering water and electricity services in rural areas of Mauritania. The project was originally conceived by an

NGO that then turned into a company. The approach, which combines both sectors by offering energy services and services for managing access to water (pumps, wells, etc.), turned out to be very efficient and effective because it bundles several products in regions where people have extremely limited spending capacity. The company used to offer carbon-fueled services but has transitioned to green energy, switching its sites from diesel generators to solar power. We ended up selling our stakes to Engie Rassembleur d'Énergie and SADEV, the impact fund of the government of Monaco.

Do you think that Africa will inexorably shift away from the all-grid model?

JMS: I don't think we will see a complete reversal any time soon. To start with, countries with geothermal or hydroelectric power capacities – classed as green and renewable – have access to systems that are extremely efficient and cost very little, but necessarily involve centralized management. These management modes are well suited to supplying cities and major industrial sites. But it is equally possible that the share in the overall mix serviced by decentralized systems will end up being considerably higher in Africa than currently in industrialized economies. This is because of the vast extent of rural zones and the inadequacies of centralized systems, which mean that many people at present are forced to use diesel generators. And decentralized services provide valuable back-up services, including to areas connected to centralized energy grids.

The spread of decentralized systems over the coming years will depend on factors as yet unknown to us. Technological considerations will have a lot to do with it. For example, will we have access to efficient battery storage systems? If the answer is yes, then decentralized solutions may well increase at a much faster rate than at present, since limited energy storage capacity is one of their main weaknesses. There are also institutional factors that are hard to predict. Will states accept their publicly owned national operators being side-stepped, as happened with cellphones? Will they allow monopolies to be broken up? Energy companies are powerful in Africa, and the establishment of major decentralized actors is not something that they will necessarily welcome with open arms.

Different scenarios are possible, making predictions difficult. It is, however, reasonable to suppose that decentralized solutions will play a far larger role in Africa than in Europe.

What do you think are the most promising innovations in financing for Africa?

JMS: First of all, before even touching on financing, the question of the organization of Africa's essential services sectors is key. It would be good to see deregulation coupled with more effective regulatory oversight. Regulatory stability makes it far easier to raise financing, domestically as well as internationally.

This last point is essential. Regarding financing for decentralized water and energy, we are talking about a scale and size of investment that should enable investors from across the African continent to participate. The capital sums involved are lower than those needed for major dams or largescale wastewater treatment plants. The decentralized model offers the opportunity for making more modestly sized investments, which should allow national actors to get involved. These types of operations need to be supported to encourage African-based actors to engage with operations in the capitalistic and corporate economy. The greater the move towards major centralized infrastructure, the more likely that financing will come from international capital.

Another extremely positive institutional evolution would be for actors operating on an international scale to team up with national project leaders. This would allow highly detailed local expertise to team up with state-of-the-art knowledge from all corners of the continent, if not the entire planet.

Impact investment is also a worthwhile source of financing for essential services. Impact funds seek a long-term equilibrium, they factor in non-financial objectives and are equally at ease talking about public policy-making

as about financial returns. There is a real opportunity for highly productive alliances to be forged between impact investors, major international corporations and national governments.

Although a diversification of financing sources is desirable, nothing can replace taxation, a wellspring for subsidies and the allocation of public funds

IMPROVING THE USER EXPERIENCE: a powerful lever to improve sanitation practices in low- income communities

Bérangère Magarinos-Ruchat
Chief Sustainability Officer,
Firmenich

Maureen Ravily
Manager, Archipel&Co



Community toilets, Pune, India - ©Archipel&Co/ Maja Bialon

Convinced that sustainable development can emerge only through public private partnerships, **Bérangère Magarinos-Ruchat** started her career in the United Nations before joining the Global Alliance for Improved Nutrition (GAIN). She is now Chief Sustainability Officer at Firmenich where she builds strategic internal and external partnerships to enable fragrances and flavors to bring a positive and innovative contribution to sustainable development globally.

Maureen Ravily is manager at Archipel&Co, a Paris-based inclusive business accelerator. For the last 10 years, she has been assisting private, public and non-profit organizations in designing, implementing and assessing their inclusive business strategies. Passionate about understanding low-income consumers' habits and preferences, she is in charge of developing Archipel&Co's "Insights" practice.

For the last decades, access to sanitation has been mostly addressed from the "infrastructure" angle: most of the effort has been placed on building sanitation facilities and developing tech-oriented equipment. Whilst these innovations are necessary, they tend to miss a critical issue: the user experience. This article further investigates this issue of user experience by focusing on one specific factor: malodor. It introduces key results from a research run by Firmenich, the Bill & Melinda Gates Foundation and Archipel&Co that explores the role of malodor in sanitation-related decisions in 10 low-income urban settlements in Kenya, South Africa, China and India.

INTRODUCTION

The need for better sanitation in the developing world is key. 40% of the world's population - or 2.5 billion people - still practice unsafe sanitation or lack access to adequate sanitation facilities, with dramatic consequences in terms of public health and environmental protection. In this context, the international community set an ambitious goal to improve the situation: Sustainable Development Goal #6.2 aims at achieving access to adequate and equitable sanitation and hygiene for all and end open defecation by 2030.

Until now, most of the efforts have been placed on improving access to sanitation infrastructure (the *hardware*). The sanitation community has primarily focused on spending large amounts of money in building toilets (individual in-house toilets or collective ones) and identifying innovative and tech-oriented solutions to improve access to equipment (e.g. container-based toilets, smart toilets, etc.). Whilst these innovations are necessary, they tend to miss a critical issue: the complexity of human behaviors. A variety of sociological, economic and cultural factors influence daily sanitation decisions

and must be considered to ensure existing infrastructure is used effectively. The question of the *user experience* inside the sanitation facility is particularly important: if the experience is poor, chances that people do not to use the facility and prefer unsafe options such as open defecation are high. Consequently, *the software* issue - where infrastructure meets the end-user - is key and should also be addressed: solving the sanitation issue will require putting the human dimension back at the center of the debate.

This is one of the ambitions of the partnership signed between Firmenich, the world's largest privately-owned company in the fragrance and flavor business, and the Bill & Melinda Gates Foundation.

FIRMENICH – BILL & MELINDA GATES FOUNDATION: A UNIQUE PARTNERSHIP TO IMPROVE USER EXPERIENCE IN TOILETS BY FIGHTING AGAINST MALODOR

Building upon the hypothesis that malodor is one of the key factors leading to a bad user experience in sanitation facilities and might contribute to reduce toilet usage,

the Bill & Melinda Gates Foundation has partnered with Firmenich to further investigate this question. In 2017, following a four-year research partnership supported by the Foundation, Firmenich launched a range of breakthrough malodor control technologies, with the ambition to “reinvent the toilet experience”. These technologies started to be integrated into affordable and sustainable toilet cleaning products targeting low-income consumers across South Africa and Bangladesh in 2018. Through the development of these game-changing toilet innovations, the objective of Firmenich and the Gates Foundation was clear: offering a better user experience in sanitation facilities, in the hope that it encourages people to use existing sanitation facilities instead of defecating in the open. By encouraging people to adopt safer behaviors and “move up” the sanitation ladder (from open defecation to toilets), Firmenich and the Gates Foundation aim at contributing to SDG 6.2.

The new toilet economy can only work if it is supported by positive behaviors and systems: no matter how efficient and innovative toilets can be, if bad smell prevents their usage, they will lack impact. Building upon this strong belief, Firmenich and the Gates Foundation decided to go further and launch a study with the objective to explore the role and impact of odor in sanitation-related decisions in low-income urban settlements of emerging countries.

10 locations of the study (in each location, between 1 and 5 low-income settlements were selected)



Figure 1

COMMUNITY VOICES: AN INCLUSIVE MARKET RESEARCH APPROACH



Community Voices interviewers discussing with a respondent, Kibera, Nairobi, Kenya - ©Archipel&Co/ Maja Bialon

The study was conducted using Community Voices®, a collaborative, inclusive market research approach co-developed by Firmenich, the Naandi Foundation and Archipel&Co. This innovative approach enables the collection of in-depth quality insights, while contributing to local economic development.

Community Voices consists of (1) identifying, training and empowering young adults from underprivileged communities to design questionnaires and interview their peers as to limit declarative bias and strengthen the authenticity of insights and (2) sharing results with communities after the end of the study to empower them, enable them to voice their concerns and make them part of the solution.

This approach has three main positive outcomes:

- **For companies and development organizations:** a unique methodology that provides more accurate and reliable data, enabling to better understand low-income consumers and optimize product development.
- **For the youth:** an innovative approach that empowers young people by creating economic opportunities and building their capacities.
- **For communities:** an inclusive model that aims to voice people's needs and aspirations and encourage them to take action for themselves.

During this study, 5 600 respondents were interviewed by 250 interviewers recruited in local communities.

The study was run by Archipel&Co in 10 low-income settlements across 4 countries (Kenya, South Africa, India and China), with a twofold objective:

- Understand the different factors that drive sanitation-related behaviors of low-income urban communities and the specific role played by malodor in this range of factors: *to what extent can malodor discourage people to use existing sanitation facilities and prefer unsafe options instead?*
- Test the malodor counteractant technology developed by Firmenich and the Gates Foundation: *to what extent can it encourage people to adopt safer sanitation practices and move up the sanitation ladder?*

Settlements were selected upon two criteria: (1) low-income areas (high level of informality, socio-economic issues, lack of access to essential services) and (2) occurrence of unimproved sanitation practices (such as open defecation). Results shared in this article only represent the realities of these selected settlements.

The study was conducted through an innovative and inclusive market research approach called Community Voices (see box below).

Results of this study are shared in this article in the hopes that it might inform public, social and private sector understanding and response to the global sanitation issue.

MALODOR: A KEY FACTOR DEGRADING USER EXPERIENCE AND INFLUENCING SANITATION-RELATED BEHAVIORS IN LOW-INCOME SETTLEMENTS

LEARNING #1. MALODOR AND LACK OF CLEANLINESS CONTRIBUTE TO OFFER A VERY POOR USER EXPERIENCE IN COMMUNITY TOILETS AND CAN DISCOURAGE PEOPLE TO USE SUCH FACILITIES

SANITATION: A KEY CONCERN FOR SLUM DWELLERS

In low-income urban settlements, sanitation is a key concern. Because of a lack of space and poor infrastructure, the majority of houses is not equipped with individual in-house toilets, and most people still use community toilets (toilets managed by municipalities, NGOs or private companies that are located within the settlement and can be accessed by all households living there).

Sanitation is always spontaneously raised by more than one-third of respondents as “one of the major issues” of the settlement, that should be addressed in priority¹. It is the primary concern raised in visited settlements in South Africa and China and the secondary concern in India. Complaints include the inadequate type and number of toilets available as well as the bad user experience in existing facilities. Concerns are particularly high amongst

¹ Other issues mentioned by respondents include lack of safety, space, hygiene, water access and employment.



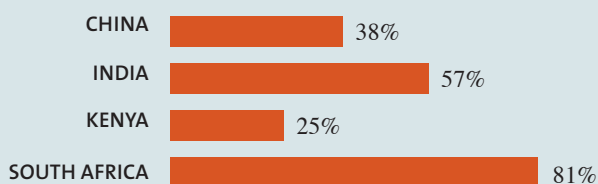
Community toilets in Mathare, Nairobi, Kenya - ©Archipel&Co/ Maja Bialon

women, who face greater challenges than men when it comes to sanitation. In Kenya or South Africa for instance, safety issues and lack of light at night place women at risk of being raped or attacked. Coping strategies against this include open defecating in groups or utilizing unimproved sanitation options at home, such as buckets that they empty in open areas in the morning. The lack of bins available for sanitary pads and the resistance by community toilets caretakers to remove such items are also deplored by women.

A POOR USER EXPERIENCE IN COMMUNITY TOILETS, MAINLY DUE TO MALODOR AND LACK OF CLEANLINESS

Generally speaking, the user experience in community toilets is very poor. In some locations (for instance in South Africa), up to 70 or 80% of users declare having a bad experience when using community toilets.

Share of community toilet users that have a bad experience when using the facility



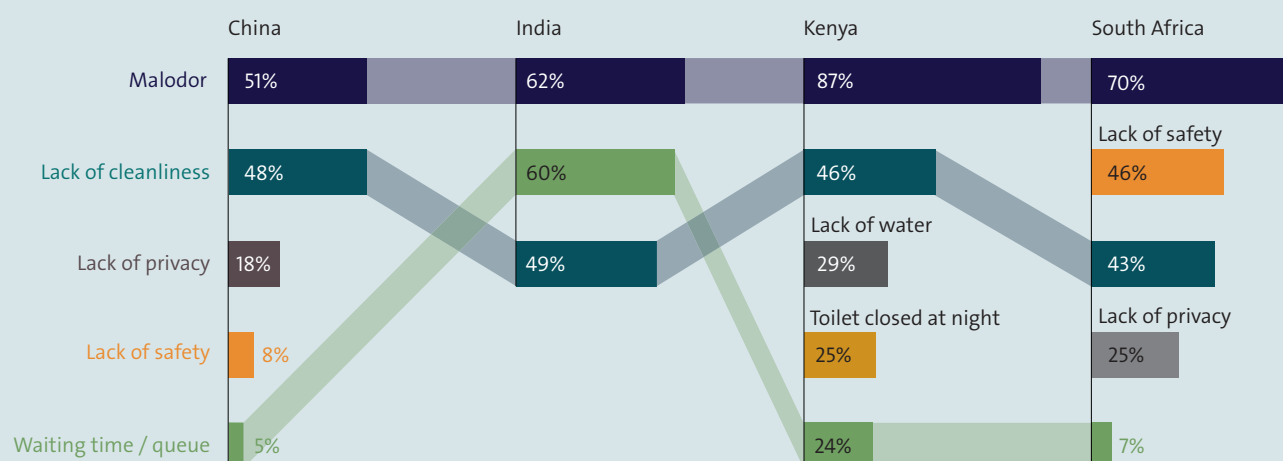
Source: Archipel&Co study, 2019

Figure 2



Community toilets in bad conditions in Alexandra settlement, Johannesburg, South Africa - ©Archipel&Co/ Maja Bialon

Main issues with community toilets



Source: Archipel&Co study, 2019

Figure 3

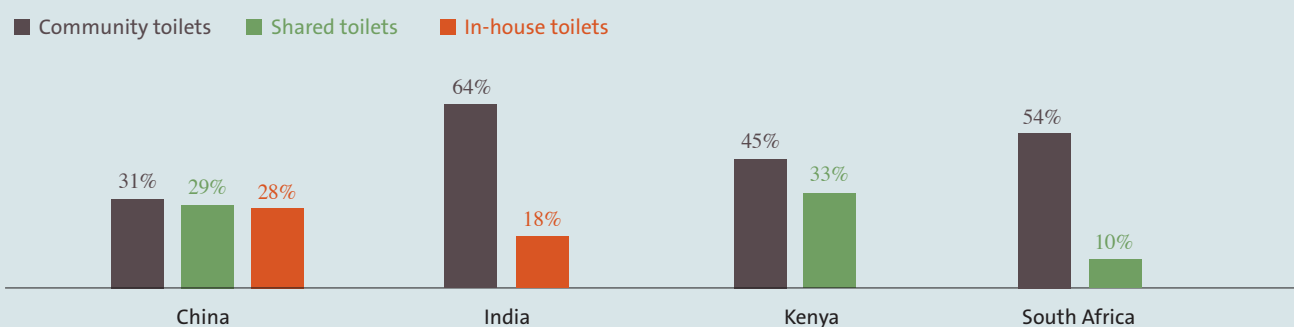
THIS POOR USER EXPERIENCE CAN DISCOURAGE PEOPLE TO USE EXISTING FACILITIES AND MAKE THEM PREFER UNSAFE OPTIONS SUCH AS OPEN DEFECATION

One of the key learnings of the study was that this bad user experience can actually discourage people to use community toilets and opt for other options.

In each location, a significant number of people do not use the safest sanitation option available to them but are in fact moving *down* the sanitation ladder and undertaking unsafe practices (i.e. open defecation or bucket used at home and emptied in the open in the morning). Between 31 and 64% of people whose only option is community toilets do not actually use them all the time and practice a less safe sanitation practice occasionally or frequently.

Open defecation is the direct (but not only) consequence of the bad conditions of community toilets. Most open defecators explain that they prefer going in the open rather than using existing facilities because of the bad conditions in which they are. Malodor and lack of cleanliness are often raised as the major issues with community toilets along with waiting time. Almost a quarter of respondents in Kenya and South Africa choose open defecation over toilets due to bad smell. In India, it is almost half of the people interviewed. In Kenya, another driver that encourages people to opt for open defecation or unsafe practices is the lack of an alternate option at night when community toilets are closed.

Share of respondents who do not use the safest sanitation option available to them but undertake unsafe practices



How to read the chart: in the settlements analyzed in South Africa, 54% of people whose only option is the community toilets do not actually use them all the time and are moving down the sanitation ladder, i.e. are using buckets occasionally or frequently. 10% of shared toilets owners do not use them and can also use buckets.

Source: Archipel&Co study, 2019

Figure 4

LEARNING #2. IMPROVING THE USER EXPERIENCE IN COMMUNITY TOILETS - BY SOLVING MALODOR ISSUES - IS POSITIVELY WELCOME AND CAN HAVE A SIGNIFICANT IMPACT ON FREQUENCY OF TOILET USAGE

Considering that malodor strongly affects the user experience in community toilets, the second objective of the study was to assess whether a malodor counteractant technology such as the one developed by Firmenich and the Gates Foundation could contribute to improve the situation and encourage people to adopt safer sanitation behaviors.

Two experiments were run to validate this hypothesis:

- A “watch-&-tell” test
- A “real-life conditions” test

THE “WATCH-&-TELL” TEST

A dedicated test was designed to assess the reactions of community toilet users and open defecators to the technology developed by Firmenich and the Gates Foundation. People were asked to visit toilets that had been treated with the technology (cleaning treatment + installation of air freshener pads) and to react. Answers to this test were only declarative.

This test aims at assessing:

1. whether the technology could encourage people with unsafe sanitation practices to start using community toilets
2. whether current users of community toilets would be ready to pay more to access toilets in such conditions.



An air-freshener pad treated with the Firmenich-Gates malodor counteractant technology installed in a community toilet for the test. The pad captures malodorous molecules and in turn releases a pleasant fragrance - © Archipel&Co/ Maja Bialon

Three key results are noteworthy:

- An overwhelming majority of respondents perceived the treatment to be effective: around 90% consider the situation “*much better than usual*”.
- Addressing malodor can encourage those with unsafe sanitation practices to move up the sanitation ladder: between 35 and 37% of people with unsafe sanitation practices declared a willingness to start using community toilets in improved conditions (cleanliness and good smell)
- Most of community toilets users are willing to pay to access community toilet in improved conditions: in India and Kenya, where people are used to pay to access to community toilets, around 70% of respondents declared being willing to pay *more* to access toilets in such conditions. In China and South Africa, where toilets are currently free of charge, the percentage is lower. Still, 28% of people in South Africa said they were ready to start paying to be able to use toilets in such conditions.

This test demonstrated that an improved user experience can actually contribute to improve the sanitation situation, by (1) shifting behaviors of current open defecators to begin using existing toilets and (2) improving willingness-to-pay for toilet usage among existing toilet users (hence, improving the economic model and maintenance conditions of these toilets).

Nevertheless, it is important to keep in mind that these effects will vary according to the local situation and the other challenges the communities may experience. Three clusters of settlements can be identified:

1. In settlements where availability issues (toilet closing at night and long waiting times) are not solved → limited effect

In settlements which have acute difficulties in toilet availability, and hence a relatively high prevalence of unsafe practices, improving the user experience will likely have a limited effect if waiting time and other access concerns are not addressed (which implies the need to build additional toilets - new facilities or additional stalls within existing facilities). In South Africa for instance, the lack of safety is a major concern and accounts for movement down the sanitation ladder at night and thus improving user experience in public toilets will not have an effect on changing these behaviors.

2. In settlements where unsafe practices are common and user experience is bad → considerable effect

This cluster occurs in settlements where a substantial number of people have unsafe practices and the difficulties associated with toilets are relatively moderate (such as malodor, cleanliness, general maintenance concerns etc.). Improving the user experience in these community toilets could have a considerable effect on both reducing unsafe sanitation practices (i.e. open defecators will use community toilets) and increasing the willingness of existing users to pay .

3. In settlements where toilets are in rather good conditions à limited effect on toilet practices (a “last-mile” solution to become open defecation-free), but a considerable impact on social cohesion within settlements

The last cluster of settlements have toilets that are in relatively good condition and subsequently have a relatively low occurrence of unsafe practices. The toilets are effectively managed by community-based organizations (as in Kenya) and are used by most of the community. Treating the odor issue in these toilets will have a limited effect on the reduction of unsafe practices as those who have such practices do so due to specific availability challenges (security and closure at night). However, the malodor treatment is appreciated by existing toilet users and most declared an increased willingness to pay if toilets were in improved conditions.

THE “REAL-LIFE CONDITIONS” TEST

METHODOLOGY OF THE TEST



Organization of the test in community toilets, Pune, India - ©Archipel&Co/ Maja Bialon

The test was performed in 8 community toilets with similar characteristics and comparable initial conditions. We used scanner counting devices to assess and compare the attendance in community toilets before and after treatment (use of cleaning products containing the malodor counteractant technology), in order to quantify the impact of these interventions on behavior change. Two toilets served as control groups (no treatment). The test was organized in three-steps:

- 1. Period 1 - Pre-intervention (6 weeks):** no treatment as to capture the regular attendance in the 8 community toilets (control period)
- 2. Period 2 – “Cleaning” (6 weeks):** cleaning and odor treatment
- 3. Period 3 – “Cleaning + community engagement” (8 weeks):** cleaning and odor treatments + community engagement activities (awareness-raising campaigns, community events, etc.)

Aware about the potential limitations of the first test (that might include a declarative bias), we ran a second test over a 6-month period in order to assess the potential impact of the malodor counteractant technology on behavior change “in real-life conditions”: if community toilets receive malodor counteractant technology and cleanliness treatment, what impact could this have on users’ actual behaviors? This test was run in Pune (India) but findings are interesting to develop and scale-up solutions in other parts of the world, including on the African continent.

There are three main lessons to be learnt from this test:

- **Lesson #1 - Improving the conditions in community toilets is highly valued by people:** satisfaction levels on general cleanliness and smell have more than doubled during the pilot test in all treated community toilets.
- **Lesson #2 - Improving user experience can lead to behavior change:** the number of people attending the treated facilities increased by 16% between period 1 and period 3. Concurrently, traffic in the control group toilets stagnated or slightly increased (1% increase). This confirms that behavior change can happen: if conditions of community toilets are improved, people are ready to start using them or to use them more often.
- **Lesson #3 - Behavior change requires long term community engagement.**

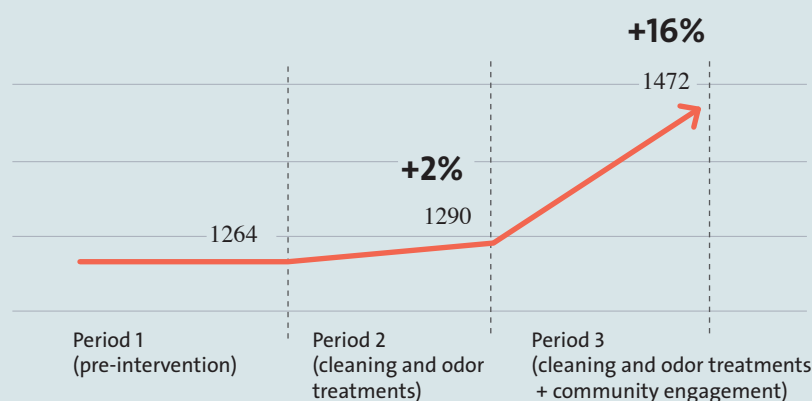
During period 2, traffic in community toilets started to increase, albeit very modestly (+2%). The real change occurred in period 3 when several actions were launched to engage communities and raise visibility of the intervention. After these engagements, traffic increased almost immediately at a much faster pace (+16%) emphasizing the absolute necessity of actively engaging communities during the process to ensure behavior change can happen. Other experiments show that behavior change curve often follows an exponential curve: as word of mouth increases, it encourages people to imitate what their neighbors do. Hence, we can hope that if the test had lasted longer, results would have continued to increase.

CONCLUSION AND RECOMMENDATIONS FOR THE SECTOR

This research project by Firmenich and the Gates Foundation reminds how important the concept of “user experience” is when it comes to sanitation decisions. If all the investments and innovations launched to improve sanitation *infrastructure* remain absolutely critical, it is key not to forget that sanitation practices are not only about infrastructure. They are deeply influenced by human factors, immediate perceptions and feelings, rational or irrational drivers that lead people to choose a practice or another.

This study provides strong evidence of the positive impact of enhanced odor and cleanliness on sanitation behaviors: an effective malodor control can significantly improve the user experience in community toilets, and thus increase the

Evolution of the number of people attending the treated community toilets on a daily basis



Increase in attendance rate is much higher when community engagement actions are conducted.

How to read the chart: Before we started to intervene, the community toilet registered an average of 1,264 entries per day (nb.: if a person uses the toilet twice a day, it represents 2 entries). In period 2, when we cleaned and put air freshener pads, it went to 1,290 entries per day (+2% increase). In period 3, when we added the community engagement activities, the number of entries increased much more rapidly, to reach 1,472 entries per day (+16% compared to period 1).

Source: Archipel&Co study, 2019

Figure 5

use of such facilities. This shows that simple triggers can be activated in order to successfully influence behaviors and promote the adoption of safer practices, along with other measures.

We encourage practitioners working in the sanitation space to further investigate these issues. In particular:

- **Shift mindset from “access to toilets” to “access to nice-to-use toilets”.** This requires a twofold effort:
 - Continue to invest in infrastructure by (1) properly maintaining and improving existing facilities (e.g. community toilets), (2) supporting the construction of individual in-house toilets, when it is feasible and relevant and (3) developing new infrastructure, more adapted to low-income settlement realities, such as waterless or container-based options.
 - In parallel, put more focus on the “user experience” to make sure existing facilities are actually used by people. Emotional and behavioral components of the sanitation topic should be considered by policymakers: customer centricity is a key condition of success. Beyond the question of odors, that is developed in this article, other factors contributing to a nice user experience should be further investigated: safety, intimacy, price, additional services, etc.
- **Promote the development and use of cleaning products that include malodor counteractant technology.** Firmenich teams are available to discuss and open to launch tests in order to further assess the potential of the technology in other geographies.
- **Create the conditions for appropriate use of such products in order to have a positive and real impact on behavior change.** Two key factors are particularly important:
 - **Community engagement:** spend time engaging local

communities to foster and entrench behavior change over the long term. Old habits die hard and behavior change never happens in one day – especially when it comes to sanitation, which is a deeply personal and cultural topic. In order to progressively encourage people to change their practices, large and diverse community engagement campaigns should be launched in targeted communities (activities with children, support to key influencers, educational campaigns, gaming strategies, etc.). In any case, they require to build trust and long-lasting relationships with local communities, which is a time- and resource-consuming effort. Consequently, organization and funding of such activities should be considered early in the process by the organizations in charge.

- **Caretakers mobilization:** caretakers are key players of the sanitation value chain that are insufficiently incentivized today. Experience shows that when they are properly motivated and recognized, they are much more effective in maintaining clean facilities, and can even contribute to raising awareness among their communities. Beyond financial incentives, social recognition and other social incentives should be considered to strengthen their self-esteem and image in the community and to empower them over the longer term (e.g. health insurance, training support for their children’s education, etc.). Funding of such incentive models should be taken into account in the business model of community toilets.

Full report with detailed results of the study: *Malodor and sanitation behaviors in low-income settlements (global report)*, Archipel&Co, January 2020
<https://gatesopenresearch.org/documents/4-6>

CONSUMER EDUCATION CAN LEAD TO BEHAVIOUR CHANGE

Gordon Achola,
Country manager, EXP agency
Nana Asamoah-Manu,
Quality Assurance lead, IFC

Younès Drici Tani,
Non-affiliated environmental activist
Andrea Weiss,
Media manager, WWF South Africa



Lighting Africa IFC World Bank Group

Gordon Achola works as a country manager at Exp Agency. His experience covers consumer education strategy design and implementation in health, sustainable energy, water, sanitation, hygiene, environment and development sectors in several African countries.

Nana Asamoah-Manu joined IFC in August 2009 and led the Lighting Africa program in Kenya till it ended in June 2018. He subsequently worked on the Zambia Mini-grids program and is currently IFC's Quality Assurance lead supporting DFID's Africa Clean Energy Programme.

Environmental activist since 2009, **Younès Drici Tani** was one of the first to devote himself entirely to the environmental cause in Algeria. After a master's degree in corporate law, he decided to multiply clean-up operations, first in his home province and then throughout the whole country.

Andrea Weiss works as a media manager at WWF South Africa. Former journalist and magazine editor, she took part in two of the most recent Journey of Water campaigns in South Africa and was involved in crisis communications during Cape Town's "Day Zero" drought.

Changes not only at macro level but also at micro level are required to create more sustainable and efficient essential services in Africa. From this perspective, how can we promote change in consumer behaviour when we know that it is difficult to transform habits and beliefs that are rooted in everyday life? A set of four articles has been chosen to describe in detail consumer education strategies put in place to create awareness and changes in consumer and citizen behavior. A comparative and analytical approach helps understand how: i) the diffusion of off-grid solar energy in rural areas is facilitated by a few key principles of consumer education strategy; ii) social network have become a civic mobilization channel for cleaning up garbage in public spaces; iii) the future of drinking water is transformed by journeys of citizen mobilization.

Consumer awareness as a central feature

Gordon Achola, Country Manager, Exp Agency

There is general consensus that social behavior change is a complex phenomenon and process that is influenced by many factors, personal and environmental. Any effective strategy employed to influence behavioral modification or change in the essential service access sector (energy, water and sanitation) must have awareness creation as a central feature. Studies have demonstrated significant relationship between awareness and consumer behavior. One such study by Ishak & Zabil (2012), notes that awareness is prior to and leads to effective consumer behavior.

Though commonly referred to as consumer awareness, this component should target different segments of the audience including current consumers, potential consumers, policy makers, gatekeepers, community level influencers and all other persons or groups that shape opinion in a specific area. Social behavior change interventions are normally faced with three consumer awareness intervention need scenarios: one where there is a complete lack of awareness about a behavior service or product, another where the awareness level is inadequate and lastly, where the target audience has the wrong information. All the three scenarios need to be anticipated and addressed in the design of a consumer education strategy. To achieve this, a reliable formative research should be conducted in a creative way to unearth deep seated target audience realities.

Consumer awareness hardly ever starts from scratch, in many cases, the target audience already has some level of knowledge about the focus product or behavior and in a few cases they have all the required knowledge but still do not practice the behavior. I classify consumer awareness as either passive or active, the former being the most common. It is the objective of behavior change interventions to activate existing knowledge and move the bearer from passive awareness to action, while disseminating new knowledge to those that do not have adequate awareness about a service, behavior or product.

Some maxims imperative in the design and implementation of effective consumer education strategies for essential services can be identified. These include:

- i.) **Relevance:** This is perhaps the most important consideration to make when designing a consumer education strategy. The message needs to be relevant to the target audience and their immediate environment, including peers and gatekeepers. So should be the choice of communication channels, materials, connection points and even time of engagement.
- ii.) **Evidence:** Adopting an evidence-based approach is hugely beneficial to consumer education interventions. Reliable data facilitates decision making, especially around target setting, path definition, learning

and assessment. Evidence-based approach calls for permanent insight gathering and interpretation, but should not be complex and costly. Simple dipsticks and documentation of learnings from daily experiences come in handy, if properly planned and executed.

- iii.) **Stakeholder involvement:** Consumer behavior is not entirely intrinsic. Hence, it is influenced to a large extent by the environment and even more so by national, community and household level influencers, opinion shapers or stakeholders. Great attention should be dedicated to the identification of relevant, stakeholders, influencers/opinion shapers, in order to engage them at the most appropriate stage, level and manner. Reading about the World Wildlife Fund for South Africa's Journey of Water campaign in this publication, the role of influencers in consumer education and behavior change communication comes to the fore.

- iv.) **Channel integration:** Channel integration increases reach potential, message intensity and believability. Carefully design messages and activities such that they can be amplified via different channels. Go with a multi-channel approach and have a clear amplification plan. For example, always design on-ground activities in a way that they can be the content for above the line media. The Lighting Africa programme's huge success, as explained in this publication, is partly attributable to the inclusion of consumer education in the program and particularly channel and message integration.

Consumer education has continued to evolve, more so in response to technologically driven trends. The next decade will see an increased shift towards remote word of mouth, especially in the developing world where smart phone penetration is incipient. Aware of this possibility, many organizations and programs have created digital transformation plans and are well on their way towards achievement of the same. The COVID-19 pandemic has forced such organizations several steps ahead in their digital transformation plans.

Social media undoubtedly forms a major part of previous, current and future consumer education strategies, with benefits that range from general awareness to behavior adoption. A perfect example of the place of social media in consumer education, covered in this issue, is the #TrashtagChallenge by environmental activist Younès Drici Tani, which went viral and catalysed worldwide behaviour change that encouraged thousands of young people to start clean up and waste collection operations in their neighbourhoods. To spur social media as a consumer education channel, influencers are oftentimes handed the intermediary role between campaigns and consumers. Popular as it has proved to be, questions abound in the

social influencer questions regarding the social influencer's approach arise, among which: Who is the best social influencer and, how relevant and committed will the selected social influencer be to a campaign?

Sufficient literature exists on how to best choose a social influencer but not so much is documented on how to make the influencer an extension of the campaign in question. In an attempt to answer the two questions, I observe that they are intertwined in the sense that a non-fitting influencer may not make an extension of the campaign, no matter how much they are trained. This is due to the fact that a social influencer is made up of many moving parts including the individual, its followers in terms of numbers and demographics, interests, core content, activity types and levels and their perceptions, among other attributes. It is therefore imperative for campaigns to check the first box by making the best selection of an influencer given their prevailing circumstances. Yet, many times, this process is hardly given the attention it deserves. Instead, influencer decisions are based merely on the number of followers, selector's preference, cost and most importantly the influencer's involvement (or lack of it) with other campaigns or brands in the market.

Deliberate matching of influencers to the behavior being promoted is often missing in many influencer decision processes. Doing so helps campaigns select the most relevant influencer; one that looks, acts and speaks the message being passed. This calls for a structured study of available influencers to identify areas of confluence between their attributes and those of the behavior/brand in question. Granted, the higher the number of followers, the higher the reach but this does not necessarily mean that there will be a

It's not enough selecting the best behavior change influencer, endeavor to influence the influencer to make them an extension of your campaign

connection between the audience reached and the message or behavior being promoted.

The reason campaigns hire influencers is mainly because influencers are better placed to be trusted and to amplify campaign messages, given their large number of aspirational followers. However, beyond selection of a relevant influencer, campaigns need to do more than an hour's briefing on the messaging or campaign attributes. They should take the influencers through a process that can be called 'influencing the influencer'. This process is quintessential in the sense that behavior change promoters should be an extension of the campaign, they should 'feel' the behavior and develop an emotional connection with the campaign before going out to speak for it.

Influencing the influencer involves a rapid, highly structured experiential engagement with a potential influencer, aimed at sharing the truth about the behavior and evoking informed belief in the content to be promoted. This way, programs are assured that the most relevant influencer is amplifying the correct campaign message in a natural and

passionate manner that leads to a deeper connection between the influencer, their followers and the behavior in question. This works magic as it filters the hidden 'sponsored' perception that followers get whenever influencers mention campaign names or messages in their engagements. Something very important to note is that influencers too, have a significant role to play in this process. One of the key roles is for influencers to take time and study

campaigns/brands in their markets so as to understand and be ready for those that resonate with their persona, and they should be able to say no to campaigns that do not run along the same gain.

Lessons from Lighting Africa experience

Nana Nuamoah Asamoah-Manu, Operations Officer, Lighting Africa, IFC

Over 250 million people in sub-Saharan Africa lack access to grid electricity. Millions across the continent therefore rely on lighting sources like candles and kerosene lamps in spite of the resultant hazardous effects on their health, wellbeing, and environment. Off-grid solar technology can provide the lighting and much of the communication and entertainment requirements for these consumers. However, in order to change their lives, people need to know about these better alternatives.

Consumer education creates awareness of these solutions and leads to the needed behavior change (Singh, 2011).

Irrespective of the positive behavior we seek, consumer education enables people to do at least one of the following things; i) make informed choices, ii) protect themselves from exploitation, and/or iii) seek a better way of doing things (Flowers, Chodkiewicz, Yasukawa, McEwen, Ng, Stanton, and Johnston, 2001). Having used fuel or biomass-based solutions for many years, the introduction of renewable energy-based solutions is not an automatic choice unless consumers are educated about off-grid electricity solutions. This is why consumer education and behavior change are critical for off-grid electricity.

LIGHTING AFRICA'S APPROACH

The World Bank Group's Lighting Africa and Lighting Global programs seek to develop markets for quality off-grid solar products in rural and off-grid areas (Lighting Africa, 2020). To achieve this, it is essential that potential consumers be adequately educated to be able to make informed decisions, leading to behavior change. Hence, we incorporated extensive consumer education into our activities.

Our approach to consumer education is not “one-size fits all” and is always tailored to the particular market or environment we are targeting. However, we are guided by these steps:

1. Market Intelligence/ Situational Analysis + Objective Setting;
2. Strategic/ Tactical planning (main approach, targeting, selection of tools, including messaging and channels);
3. Allocation of resources (Purse, People, and Period);
4. Evaluation and Adaptation.

These are applied as follows:

First, we conduct scoping activities to understand the consumer and the market. Right from the beginning, we seek to understand what is being used for energy locally, the resultant challenges, and lifestyle decisions in relation to this. Through this process, we also develop clear objectives in terms of potential reach and impact. Models used for this information gathering phase include on-the-ground focus group interviews, engagement of opinion leaders, and good background studies.

Three takeaways: (1) each market is different, (2) addressing the entire eco-system will support effective change and (3) be sensitive to the environment and deal with distracting “noise”

Second, based on the findings from the situational analysis, we develop the most suitable consumer education strategy for the setting. This includes creating messaging that will be useful and resonate locally, as well as choosing the channels with the most impactful reach. Over the years, the program has used both mass media and face to face activities like vernacular (local dialect) radio, group forums, and roadshows. More recently, we have also begun using social media (mobile phone accessible) to reach target audiences.

The importance of the enabling environment for effective behavior change must also be noted. This means the campaign must, right from the beginning, identify and engage the stakeholders who will facilitate this change. For example, it is critical to engage the potential retail market that will stock the products, or potential financial institutions like MFIs¹ that will provide funding enabling purchase. In many Lighting Africa programs, local electrical shops and supermarkets were found to be relevant solar sales outlets, and organizations that accessed the target

groups like factories, commercial farms, and NGOs², were non-traditional yet effective sales channels. In Kenya, we found that educating relatives based in urban areas during festive periods like Christmas was an effective strategy to promote uptake amongst those traveling to “Shags” (their rural homes) with gifts. They became excellent facilitators of behavior change in the target group once adequately informed.

With the messaging, language, and channels determined, a clear action plan is then developed.

The next step is to allocate adequate resources to the different elements of the plan. Consumer education is not cheap and its effects are only seen in the longer term, hence it requires know-how and resilience. In our experience it was crucial to make adequate financial resources available for the entire campaign. Identifying the right delivery agency is also key. We engaged agencies that had a strong understanding of local rural behavior change using experiential processes. We recruit these agencies at the beginning of the process so they are involved in the situational analysis, tool development, and planning.

For sales partners, Lighting Africa exclusively engaged suppliers of products meeting Lighting Global Quality Standards (some known as “associates”) to ensure that consumers were receiving products they could rely on. These partners needed to be adequately resourced to take part in and benefit from consumer education campaigns. These and other partnerships and collaborations were found to be invaluable. We worked closely with the industry associations to get their support. It is also very important to have government – particularly local government – buy-in, to reach consumers. In some countries, as it was the case in Ethiopia, the government's Energy Bureaus played an instrumental role in the Lighting Africa consumer education campaigns.

This entire process is cyclical in nature, with regular reviews conducted both internally, and with key stakeholders. In such reviews, the program evaluated the number of consumers reached, their feedback on their experiences with solar, their level of awareness, the number of retailers on board, changing demand, and critical obstacles to the uptake of solar products. Where a weak spot is found, these are quickly addressed and the strategy updated, making sure to adapt resource allocation as well. For example, the earlier Lighting Africa campaigns did not include messaging on how consumers could access financing. However, during the review process, it came to light that although the core messaging was well received, people could not afford the upfront product costs. Bringing on MFIs and SACCOs³ to

1 MFI – Microfinance Institution

2 NGO – Non-Governmental Organization

3 SACCO – Savings and Credit Cooperative Organisation

support the financing, greatly improved solar adoption. This uptake was further improved when PAYGO⁴ was introduced and the consumer education campaigns began containing consistent information about how consumers could get financing through MFIs, SACCOs, or PAYGO suppliers.

LESSONS LEARNT

During the course of carrying out consumer education campaigns in over 10 countries and 3 continents by Lighting Africa and Lighting Global, many lessons were learned. Those that could define success or failure are already highlighted above. Three key take-aways are:

a) Each market is different. A consumer education campaign must be aligned to the market and the target consumer to be successful. Specific messaging around solar that is successful in market A, may not be useful in market B. Therefore, ensure you listen to the consumer to determine the best approach to trigger their behavior change.

b) Addressing the entire eco-system will support effective behavior change. For example; ensure necessary buy-in from opinion leaders, authorities and relevant partners/gatekeepers. Ensure there is adequate supply of products and that suppliers are plugged into campaigns with their stocks. Engage authorities on issues of counterfeiting and

bad quality products, as if not addressed, they will cause loss of confidence in off-grid solar as a whole.

c) Be sensitive to the environment and deal with distracting “noise”. Where there is mixed messaging due to external circumstances, learn to modify or pause campaigns. For example, where there was political tension, we adjusted or waited for a more appropriate time.

Ultimately, successful consumer education requires flexibility and relevance to the target consumer and market. It is also essential to note that behavior change is not instantaneous; it requires patience and continuous effort to be impactful.

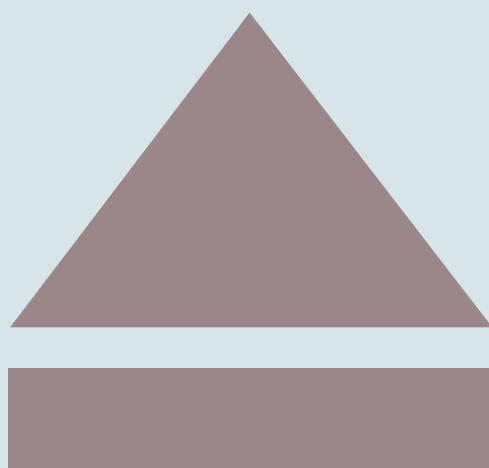
REFERENCES

- 1) Flowers, R., Chodkiewicz, A., Yasukawa, K., McEwen, C., Ng, D., Stanton, N., and Johnston, B. (2001). What is Effective Consumer Education? - A literature review. Australian Securities & Investments Commission. Centre for Popular Education. Retrieved from http://download.asic.gov.au/media/1337018/EffectConEd_report.pdf
- 2) Lighting Africa (2020) -Retrieved from <https://www.lightingafrica.org/>
- 3) Singh, S. (2011). Influencing behavioral change by customer engagement amongst youth. Adolescent Health, Medicine and Therapeutics 2011 Edition 2, pg 123–132. doi: 10.2147/AHMT.S17856 Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3926774/>

⁴ PAYGO – also known as “Pay-as-you-go” is technology that allows end-users to pay for solar energy in periodic instalments whilst they use the products.

A model of Consumer Education refinement (CE +) from Lighting Africa

What does C.E. entail?



Each CE day

- 6 forums 20+ people, 1 hr session Target; CBOs, Churches, Women's groups Youth groups etc.
- 1 Roadshow 1,000 people, market day, centre (3 - 4 hrs)
- Local vernacular radio

PLUS

- SMS (1,600 Nov–Dec. 5,800 MAY – JUNE)
- MFIs
- Radio interviews – Brand specific
- Outlet introductions + posters
- Plantations/ Organizations
- Retail workshops
- Newspaper supplement

OPTION – sponsored CE. Distributors, NGOs, YIKE

Strengthening civic action through social networks

Younès Drici Tani, non-affiliated environmental activist

A LOOK BACK AT THE #TRASHTAGCHALLENGE

In 2018, environmental activist Younès Drici Tani published on social media an astonishing picture of a clean-up operation in an Algerian countryside. He followed the #TrashTagChallenge, a hashtag and challenge launched a few years earlier without much echo. The challenge is simple: find a polluted or waste-covered place, clean it up, and post on social networks a picture of the place before and after the operation. Younès Drici Tani's picture quickly travelled around the world, demonstrating that a simple action can have an almost immediate impact on its direct environment. The #TrashTagChallenge went viral and for several months, thousands of photos of rivers, beaches, fields and forests cleaned all over the world bloomed on social networks. The phenomenon is still going on today and continues to change behaviors in favour of waste collection and the preservation of nature.

Your picture and the #TrashTagChallenge has been a worldwide success and has encouraged thousands of young people to start clean-up and waste collection operations in their neighborhoods. How can social networks be an accelerator of environmental behavior change?

Younès Drici Tani: Social networks have an essential role to play in mobilizing citizens. As they are easily accessible, they allow everyone to share content, opinions and ideas and, above all, to encourage others to take action. In the case of #TrashTagChallenge, a real community was created online. Citizens participated from all over the world demonstrating the ability of people to unite to face a global environmental problem that affects all of us. And all of this was done without raising any money.

What is interesting is not the tool itself but the use that is made of it. Thousands of totally useless challenges, with no social impact, exist on these same social networks. I exploited the fun and viral side of these challenges with the #TrashTagChallenge to have a positive environmental impact. In this case, social networks serve citizen engagement and behavior change.

Do you find that awareness of waste collection and recycling has accelerated in recent years, particularly in Algeria?

Y.D.T.: I have been an environmental activist for more than 10 years. This struggle requires great perseverance. But the signals are rather positive, and awareness of this issue is growing fast. The success of the #TrashTagChallenge is a good example. I observe changes in habits, especially among younger people who are much more conscious than previous generations. In my neighbourhood, children are launching their own initiatives to clean up the streets.

There are several key elements to accelerate awareness and action:

First, people need to take action at their own level, and that's why I'm already encouraging them to take action individually. I am acting as an individual and not as part of an association. I think that ecology must exist without any structure because it is in the hands of each one of us. Then, we must bring the subjects back to the individuals as closely as possible. The issue of waste management is also linked to issues of well-being and community living. My awareness raising work brings to mind the human, collective and societal aspects of the issue. Finally, access to information, especially for children, is a key factor. Ecology is not sufficiently taught in schools. Understanding the natural limits of the planet and the main principles of ecology are yet essential elements to ensure that new behaviors are adopted in a sustainable manner.

Many analysts, particularly those who are sensitive to ecology, consider that the global health crisis we are experiencing could act as an electroshock and accelerate progress in the ecological transition. Do you share this vision?

Y.D.T.: I do think that the Covid-19 crisis will lead to a faster and more widespread collective awareness. The lock-down offers a time for reflection and allows us to take a new look at our surrounding environment. We can see cleaner air, more vegetation and animals, a renewed calm... Many of us are sensitive to this and will adapt our lives and habits at the end of this crisis.

SHOW – DON'T TELL: Journey of Water connects urban dwellers with where their water comes from

Andrea Weiss, Media Manager, WWF South Africa

When it comes to water security, South Africa is a country that is particularly vulnerable to climate change, relying primarily on surface water dams for its water supply. At 490mm a year, its rainfall is around half the world's average and, to complicate matters further, this rainfall is highly seasonal and increasingly erratic as the planet warms up. In relative terms, because of its larger population and variable rainfall, South Africa is in fact more water scarce than neighboring Namibia, despite the fact that Namibia is a desert with only half of South Africa's average annual rainfall.

Research done by the Council for Scientific and Industrial Research (CSIR)⁵ shows that only 10% of the surface area of South Africa supplies some 50% of surface water runoff. This study identified 22 parts of the country as Strategic Water Source Areas. These are the most important sources of freshwater from a national perspective because they supply a disproportionately high amount of the country's water in relation to their size. The CSIR work shows that water from these areas supports half of South Africa's population, 64% of the economy and about 70% of irrigated agriculture – yet only 18% of this land area enjoys any kind of environmental protection.

The objective of the Journey of Water is to immerse city dwellers in an outdoor experience that follows water from its natural, mountain source to the city – tracing its path from a pristine environment down river courses into dense urban areas. On route, participants see, experience,

and learn what happens to water as it makes a long and arduous journey to the city. This story is about how water is used, moved, and distributed. It is about water quality and quantity and also often showcases positive examples of stewardship and what people – from rural villagers to commercial farmers – are doing to look after water and the land it journeys through. Launched in 2013 by WWF South Africa, this flagship campaign brings home the message to urban people that “water doesn't come from a tap”.

WWF South Africa had the right technical network of excellent expertise and reach to tell people about water conservation. But we also know that changing behaviour is hard and good communication is critical. The Journey of Water was created by WWF South Africa with the support of Ogilvey, an advertising agency, to focus on these Strategic Water Source Areas identified by the CSIR study which have been the location of each of WWF South Africa four “journeys” to date.

The campaign is based on the following pillars.

A UNIQUE COMBINATION OF PHYSICAL CHALLENGE AND REAL-LIFE EXPERIENCE TO RAISE AWARENESS ABOUT WATER

Many journeys involve physical activities such as hiking, paddling and, most recently in South Africa, zip-lining through high mountain gorges. Underpinning this physical journey is the message that the best way to ensure there is water for human needs is by looking after the natural environment or “ecological infrastructure”, keeping catchments healthy and clear of invasive vegetation and reducing pollution into rivers and streams. For the first Journey of Water, the Berg River Dam (funded by the World Bank) was an aptly chosen starting point – being the first dam in South Africa to incorporate environmental principles into its design to allow the release of water for ecological needs in the river. Alongside this, the catchment that feeds the dam was cleared of invasive vegetation to ensure increased water flow into the dam and to help protect the highly biodiverse indigenous vegetation (fynbos) in the surrounding mountains. The first journey was the longest, starting with a 26km hike over the top of the mountains, through the Winelands and across the Cape Flats, eventually into the historic underground water tunnels in Cape Town. That's how participants came to understand why Cape Town was first named “Camissa” or “sweet waters” – this water runs out of sight and mind in these tunnels beneath the city and into the sea.

⁵ CSIR, Protecting South Africa's strategic water source areas, May 2017



Walkers at Berg River Dam - ©Trevor Ball

A SPECIFIC TARGET AUDIENCE TO MAKE A REAL DIFFERENCE

Water users from urban areas were the target audience in South Africa and a group who were well placed to make a real difference in terms of power of voice and sustainable consumption. To be even more specific, WWF South Africa's communication strategy targeted the "New Million", a term coined to describe urban South African millennials. A secondary audience for the campaign was partners and key stakeholders in the water sector and media (both digital and traditional) to gain the necessary exposure that is needed to deliver both impact and understanding of the campaign.

CALLING ON WATER EXPERTS AND AMPLIFYING MESSAGES THANKS TO KEY INFLUENCERS

Aquatic ecologist Dr Jackie King was invited to be the opening speaker of the first Journey of Water. Dr King is a WWF-SA board member who went on to become the 2019 Stockholm Water Prize Laureate for her global contribution to river management by advancing the science into environmental water flows. Her internationally lauded work focuses on how much water is required in a river to keep it alive and ecologically healthy.

For each "journey", a handful of key influencers, such as actress Carishma Basday or extreme swimmer Ryan Stramrood, are invited to participate on a pro bono basis and to amplify the messages through their channels. In the process they are exposed to typical challenges in catchment areas and are able to use their own voices to tell the story.

While the original aim was to create awareness rather than any specific call to action, the campaign had another real benefit. This was that it picked up very concretely on the policy and environment/public discourse around water – leading to a much sharper focus on ecological infrastructure at a national scale. It is worth noting that the first sentence used at the launch of a National Water Master Plan for South Africa by the Infrastructure Minister was the line "water doesn't come from a tap".

A TRUSTED VOICE

The Journey of Water also played a role in establishing WWF South Africa as a key voice during the 2017/2018 'Day Zero' drought which saw the City of Cape Town come perilously close to being the first major city in the world to run out of water. As a trusted voice and a first responder in this crisis, WWF published and disseminated a series of 10

"water files" addressing many of the most pressing issues that citizens were facing – using a network of technical expertise and translating this information into non-technical language. These files were eventually collated into a single publication⁶ for use during the inevitable future and current droughts.

During this water crisis, Cape Town reduced its water consumption by half, largely through behaviour change on the part of citizens. As water awareness was raised, many residents of the city began to measure and reduce their water consumption, implementing measures such as the reuse of greywater for domestic use (for the flushing of toilets), cutting their shower times and capturing rainwater in rain tanks on their properties for garden use.

JOURNEY OF WATER GOES GLOBAL

In the intervening eight years since the first Journey of Water first kicked off in South Africa, the campaign has captured imaginations and gathered momentum around the world. The first country to follow South Africa's lead was Zambia, which focussed its journey on the Kafue Flats – an increasingly water stressed stretch of the Kafue River, which provides most of the capital's water and much of the country's electricity as well as sustaining the sugar cane industry and unique biodiversity. Malaysia has now run three "journeys", rapidly capturing media and social media attention. In Brazil, participants journeyed by foot, horse, bike and boat along the Paraguay River to highlight threats to the Pantanal, the world's largest tropical wetland which is home to over 4000 species and a vital source of water for rural communities and distant cities. In China, the journey directly reached thousands of people, but this paled in comparison to its huge impact on social media.

Before the Covid-19 pandemic gripped the world, 2020 was shaping up to be another leap forward with journeys planned on the Mara River in Kenya and the textile-dominated and biodiversity rich Buyuk Menderes River in Turkey as well as a potential multi-country journey through the Amazon of Europe taking in Austria, Hungary, Slovenia and Serbia. Running journeys of water in a record number of countries in 2021 will be essential to remind people that this water does not come from a tap but from nature – from healthy rivers and wetlands.

WWF South Africa had the right technical network of excellent expertise. But we also know that changing behaviour is hard and good communication is critical

⁶ WWF, The Water Files communicating in a time of water crisis, 2018

WHY ACCELERATING PARTNERSHIPS IN THE SANITATION ECONOMY REALLY MATTERS

Erin McCusker

Chairwoman of the Toilet Board Coalition and Global head of SATO (Lixil)



Global Sanitation Economy Summit, 2019 - ©Toilet Board Coalition

Chairwoman of the Toilet Board Coalition, Erin McCusker serves as the Head of SATO, a part of Lixil, which aims at providing innovative and affordable solutions to the over 2 billion people across the world without access to basic sanitation. Previously, she worked as a strategy consultant and senior project leader in top-tier consulting firms and international foundations – notably the Bill and Melinda Gates Foundation – with a range of in-depth experience across global health and development topics. She holds an MBA and BS in bioengineering.

Initiated in 2014, the Toilet Board Coalition (TBC) has the ambition to address the global sanitation crisis by accelerating the Sanitation Economy – a market valued up to \$12 trillion a year. Business-led, the Toilet Board Coalition believes in market-based solutions, commercially and financially sustainable, to provide universal access to sanitation (SDG No. 6) and reach low-income consumers in emerging markets. To this end, the Coalition brings together large corporations, international development agencies, international organizations, entrepreneurs and NGOs. Through its 12-month accelerator program, the Coalition creates partnerships between sanipreneurs and big corporations to address the numerous barriers preventing innovations to scale. As “Every business’s business”, the Sanitation Economy could unlock promising and profitable opportunities in all sectors, including agriculture and preventive health, even more so in the aftermath of the global COVID-19 pandemic.

The Toilet Board Coalition defines itself as a “business-led public-private coalition for sanitation”. What is the ambition behind this alliance of multiple stakeholders?

Erin McCusker: Initiated in 2014 by Unilever, Firmenich, Kimberly-Clark and LIXIL, the Toilet Board Coalition has the ambition to address the global sanitation crisis by accelerating the Sanitation Economy. The Toilet Board Coalition works at promoting the sanitation economy as a powerful framework to provide universal access to sanitation, in line with Sustainable Development Goal No. 6. Whereas sanitation access is usually considered as a public cost, we believe that delivering sanitation products and services can unlock numerous business opportunities and create value for all stakeholders. It is worth recalling that the Business & Sustainable Development Commission's Better Business Better World report cites “water and sanitation infrastructure in cities” among the 60 biggest market opportunities related to delivering SDGs – and estimates it could be worth at least \$12 trillion a year, while generating 380 million new jobs by 2030 in developing countries. The Toilet Board Coalition estimates the Sanitation Economy to be a \$97 billion market opportunity in India by 2021 and scaling-up to \$148 billion by 2030. In the African continent, the Sanitation Economy also represents a huge market opportunity, and a powerful lever to address the continent's broader development challenges. Indeed, the work of the Toilet Board Coalition has found that, on average per 1 million people served, countries can gain \$70 million in increased productivity through the provision of safe sanitation. In addition, on average, every \$1 invested sees a return on investment of \$5 in positive externalities – including healthcare services and increased attendance at schools.

More precisely, the sanitation economy links three marketplaces for business and social benefit: the toilet economy, the circular sanitation economy and the smart sanitation economy. How is the value being generated? How is it captured? What are the most innovative and sustainable business models to solve sanitation challenges? Those are the kind of questions we are looking at.

The Toilet Board Coalition puts great emphasis on the private sector. That being said, the sanitation economy cannot thrive if it does not engage with all stakeholders – big companies, smaller entrepreneurs, governments, NGOs, etc. – as no one can solve sanitation challenges alone. For instance, entrepreneurs and businesses cannot operate efficiently and deliver sanitation services and products if the regulatory framework and public standards are unsuitable. In order to reach local communities, partnering with community-based organizations and NGOs also proves

to be a major asset, and a prerequisite to build trust and a strong social license to operate. The Toilet Board Coalition is designed to catalyze the energies of all stakeholders involved in the field of sanitation to help address this issue. The coalition brings together large corporations (Unilever, Kimberly-Clark, Firmenich, Tata Trusts, etc.), international development agencies (USAID, ADB, etc.), international organizations (World Bank, Unicef), entrepreneurs (Tiger Toilet, Sanivation, Sanergy, etc.) and NGOs (water.org, PSI, WaterAid).

Going a step further, our goal is to demonstrate that the sanitation economy does not benefit only companies working in the toilet or hygiene business, but can impact and improve businesses in all sectors – mining, agriculture, health, forestry, etc. As we like to put it, the Sanitation Economy is every business's business. Just as climate change affects any sector, the same goes for sanitation and hygiene. Looking at each sector through the Sanitation Economy lens is something we wish to expand in the next five years.

Concretely, how does the Toilet Board Coalition encourage innovation and partnerships in the Sanitation Economy?

E. M.: So far, the Toilet Board Coalition has built different mechanisms to create engagement around the Sanitation Economy.

The accelerator, launched in 2016, is our flagship program, with the most impact. Each year, we select up to 10 entrepreneurs (sometimes referred to as “sanipreneurs”) that are developing commercially viable businesses across the sanitation economies in emerging and frontier markets, including innovative sanitary-ware infrastructure, products and service providers; toilet resource collection, treatment and transformation (circular resource recovery, up-cycling to water, energy, nutrients) or digital applications for sanitation and preventive health care, and so on. In short, we look for more than toilets alone and favor the most innovative ideas and business models that have a potential to scale – two key criteria of selection for us.

Our Accelerator program lasts 12 months. Selected entrepreneurs are paired with members of the TBC, and benefit from tailored mentoring sessions with business and technical experts from leading multinational companies. Among the 2019 accelerator cohort, we count Arrebol, an early stage waste management company based in Peru; H2O Sanitation, a Circular Sanitation Economy based in Durban, specializing in flushable off-grid sanitation in peri-urban and rural areas; and Pit Vidura in Rwanda, a sanitation

Whereas sanitation access is usually considered as a public cost, we believe that delivering sanitation products and services can unlock numerous business opportunities



Global Sanitation Economy Summit, 2019 - ©Toilet Board Coalition

logistics company developing tools and technology to train, equip and employ historically marginalized waste workers to provide safe services.

This is a win-win approach, as private companies can learn more about realities on the ground and get a better sense of the needs and barriers faced by consumers in their daily lives. Entrepreneurs also have access to TBC's investor community and join the TBC Network, our global peer-to-peer network of sanitation business entrepreneurs. Most importantly, at the end of the mentoring program, commercial partnerships are concluded. Hence, several 2018 accelerator graduates entered commercial partnerships with Toilet Board Coalition members: Tiger Toilets, partnering with LIXIL Corporation; Ti Bus, partnering with Firmenich; GARV Toilets, partnering with Unilever; and Biomass Controls, partnering with USAID and Kimberly-Clark.

The social impact of the businesses supported by the Accelerator Programme are measured, based on their business performance in delivering the increased access, use and adherence to improved sanitation.

Recently, we also launched a new initiative with our partner Kimberly-Clark: the **Women in the Sanitation Economy Innovation Lab**. This lab is intended to cultivate and catalyze early-stage ideas and businesses within the Sanitation Economy that are either women-led and/or women's health focused. The "Innovation Labs" present a useful framework for the TBC to target specific gaps in the sanitation economy from a technological, business model, demographic or geographical perspective.

On the ground, we also work on scaling and testing our demonstration projects. In 2018, we completed a feasibility study in Assam (India), to assess and understand the benefits of implementing a Circular Sanitation Economy system in a tea plantation. We worked in association

with Tata Global Beverages and Ethical Tea Partnership to do so. We notably focused on elaborating new systems, technologies, and infrastructures to capture toilet resources. Currently undervalued, they can produce feedstock to create organic fertilizers and energy, leading to cost savings and environmental benefits. It is estimated that 15.6 million global tea workers and their families produce around 33 billion liters of Toilet Resources every year – resources which could be converted into biofuel, electricity or co-compost, with lasting economic, environmental and social impacts.

In Pune, one of India's 100 smart cities, we worked in collaboration with the municipal authorities to conceive the framework of a "smart sanitation city" and assess to what extent the smart sanitation economy could be integrated into their roadmap.

Testing our key studies and assessing the value of the sanitation economy for specific industries or geographic areas like South Africa¹ helps us "evangelize" and raise awareness on the sanitation economy.

As a business-led coalition, the Toilet Board Coalition seeks to develop market-based solutions in the field of sanitation. What are the advantages of such solutions?

E. M.: The Coalition aims at demonstrating that sanitation can be delivered profitably to underserved communities. Following its formation in 2014, the TBC carried out a landscaping exercise to identify promising sanitation business models. This study identified about 100 pioneering projects, implementing or testing market-based approaches to deliver sanitation to low-income consumers.² What makes these projects distinctive is that they serve the Base of the Pyramid (BoP) in a financially sustainable manner, by selling improved sanitation solutions at a price that the poor are willing and able to pay.

Market-based solutions, given that they are commercially and financially viable, help ensure longer-term sustainability for sanitation innovations. Favoring self-sustaining business models, even if they do not charge the consumer directly, allows the sanitation ecosystem to move away from charity aid and traditional philanthropic approaches, and to be independent of outside funding. Additionally, such solutions place the end-consumer at the center, as understanding consumer acceptance and usage is critical to designing the right solution. Contrary to pure development models, market-based solutions answer to a demand, and often prove to be more adapted to the effective needs of the populations.

Still, we must acknowledge that market-based solutions

¹ *The Sanitation Economy Opportunity for South Africa*, 2019.

² Graf, J., Kayser, O., and Brossard, S. (2014), *Designing the Next Generation of Sanitation Businesses*, Hystra for the Toilet Board Coalition, Agence Française de Développement, UK Department for International Development, Stone Family Foundation, Kimberly-Clark, Unilever

are encountering barriers to being scaled up in many places around the world. First, the economics of the sanitation economy are not easy to capture and understand, and vary a great deal depending on the context. Besides, consumers' willingness to pay is usually low, as it is commonly accepted that governments and public actors should take over sanitation costs. Consumer acceptance is also challenging to secure. In many emerging markets, talking openly about sanitation, menstrual hygiene products, sewages or open defecation still generates a lot of stigma. Advocating for decentralized solutions, notably regarding waste treatment, while sewers are considered as the gold standard, can also prove to be challenging. The ambition of the TBC is to help entrepreneurs and business find the best solutions to address these barriers. Large corporations like TBC members can play a crucial role in addressing them: hence the pivotal role of our mentorship program. For instance, consumer goods companies can leverage their marketing expertise to develop better sanitation marketing campaigns, while construction companies can help with manufacturing quality and affordable toilet units.

What are the most promising innovations that you see in the sanitation economy for the upcoming years on the African continent?

E. M.: In Africa, among the most promising innovations are the ones aiming at encouraging safer behaviors regarding open-defecation free (ODF) communities, while pushing for improved, affordable access to sanitation. For instance, the SATO brand of products, for which I work, launched in 2013 with one model, the SATO Pan, which was created to improve the user experience and safety of open-pit latrines in rural communities, and currently delivers improved sanitation to over 6 million users in over 15 countries.

More and more entrepreneurs are also focusing on waste treatment and aiming to turn waste into value – whether in the form of food pellets, fuel, energy, and so on. In Kenya, Sanergy built a network of cartridge-based sanitation units that collect waste safely and convert it into usable high-value end products, including organic fertilizer, insect-based animal feed, renewable energy, etc. In South Africa, Pennine Energy Innovation also launched the SavvyLoo, a portable desiccating toilet with an integrated mobile desiccation system that provides output to be used as compost. In Ghana, Safisana treats toilet and solid organic waste from slum communities and turns it into electricity and compost, before selling it to local farmers and local energy companies.

Finally, innovations embracing the “Smart Sanitation Economy” framework have a real potential in the future. This approach could be applied to all three marketplaces of the Sanitation Economy. In the Toilet Economy, this “smart shift” could be accelerated through the

introduction of smart toilets, e.g., smart public and community toilets optimized by environmental, usage and biosensors, providing valuable Sanitation Intelligence for city decision-makers, operators, businesses and users. In the Circular Sanitation Economy, a promising lever of change is encompassed by smart treatment of waste, for instance monetizing the re-use of resources, to enable efficient recovery and conversion to reuse products (such as energy compost and water). Ultimately, in the Smart Sanitation Economy itself, emerging technologies can now leverage the data produced by sanitation services to provide preventive health insights. For instance, real-time surveillance for infectious disease circulation via biosensors and sampling in public toilets can provide early warning of public health outbreaks. This data could hence drive cheaper, more effective health care.

Five years after the launch of the Toilet Board Coalition, do you see a shift in the way sanitation issues are considered?

E. M.: The last 18 months were, I believe, crucial for the Toilet Board Coalition. We progressively witnessed a big change in the way private and public actors look at sanitation challenges, notably during our Global Sanitation Economy Summit, held in November 2019. As noticed during the summit, education and awareness raising on the value of the Sanitation Economy framework are less necessary, and an increasing range of actors are ready to act. Five years after the launch of the TBC, the time has now come for us to strengthen and replicate what we have built so far. As I mentioned before, our hope and goal for the upcoming years is to see an increasing range of businesses, seemingly far removed from the Sanitation Economy, realize that they too can find value creation opportunities in this sector. The smart sanitation economy, for now under-developed compared to the toilet and circular economies, offers very exciting perspectives.

Obviously, the pandemic, by suddenly and blatantly reminding the world of the essential value of proper sanitation and hygiene, and that billions of people still lack access to that, is also fostering a drastic shift of the conversation, and is likely to accelerate the Sanitation Economy.

MEASURING THE IMPACT OF DECENTRALIZED ELECTRICITY PROJECTS: a triangulation approach

Jean-Claude Berthelemy
Emeritus professor at University Paris 1, senior fellow at FERDI



Jean-Claude Berthelemy is emeritus professor at the University Paris 1, Panthéon-Sorbonne. A specialist in development economics, he helped set up the interdisciplinary journal *Field Action Science Reports* as editor-in-chief of its economics section, and is associate editor of the *Journal of African Economies, Savings and Development* and of the *Revue d'Economie du Développement*. He was previously director of research at the OECD's Development Center as well as director of France's Center for Prospective Studies and International Information (CEPII). He leads the FERDI research program on access to electricity.

My thanks to Mathilde Maurel for her comments. This contribution was prepared as part of FERDI's sustainability program and as such it benefited from support from the French government, delivered via the Future Investments program of the national research agency (ANR) under reference ANR-10-LABX-14-01. Further information about CoSMMA can be obtained from the following address:

<https://ferdi.fr/en/programs/access-to-electricity>

FERDI has created a unique initiative to evaluate the impacts and identify best practices in projects for access to essential services, using decentralized electrification projects as its basis. Large amounts of evaluation data covering such projects have been collected into a database called CoSMMA (Collaborative Smart Mapping of Mini-Grid Action). The evaluations available are of variable scientific quality, with most being of low quality. An innovative approach is suggested to overcome this drawback, based on the triangulation principle, which makes it possible to evaluate the success of a project with an acceptable level of accuracy. It is then possible to construct a meta-analysis to identify factors for success.

There are two primary lessons to be drawn from the data available in CoSMMA. The first is that projects seeking to increase the uptake of very low-power equipment have little chance of lasting success. Success for projects of this type will involve construction of mini-grids, not individual solutions, and therefore require collective action at the local level. The second lesson, informed by this first observation, concerns the importance accorded to questions of governance. Bottom-up governance models are more likely to succeed than top-down approaches. Lastly, good quality regulation of the sector increases the probability that the project will succeed. However, this conclusion also serves to highlight the lack of available data on the local governance structures overseeing these projects.

INTRODUCTION

Electricity is an essential service, but access to it is very limited in many rural areas, particularly in sub-Saharan Africa. Power grids cannot be extended because of the costs involved, but decentralized electrification solutions are now possible. Considerable experience in this field has been acquired in recent years, driven in large part by the falling cost of manufacturing photovoltaic panels. But scaling-up remains difficult in the absence of identified best practices capable of being widely applied.

Most rural electrification initiatives encourage people to adopt individual solutions (SHS, Solar Home Systems), as these are by far the easiest and fastest to roll out. SHS uptake has unquestionably been a vector for progress, but SHS has their limitations. These are low-power installations, generally less than 1 kW, and this limits the ability of projects to kick-start sufficient socioeconomic uplift to ensure their sustainability. But work to evaluate decentralized electrification projects has also tended to focus on SHS, making it harder to highlight the superiority of other solutions with certainty. In particular, micro- and

mini-grids that rely on collective management of generators of a capacity greater than available with SHS have been relatively little evaluated. Similarly, the focus on SHS has largely prevented examination of the types of governance specific to the collective action models encountered in mini-grid projects, as apply to all projects setting out to produce public services at a local level.

Analyzing these projects serves a twofold purpose. Above all, it leverages the available data to identify the success or failure of decentralized electrification projects; success being defined by the observation of proven socioeconomic uplift in localities where such projects have been installed. Next comes the idea of using the data to pinpoint best practices, by which we mean factors liable to increase the probability that such projects will succeed. These analyses center on the construction of a unique database, CoSMMA. Data available in CoSMMA is of extremely variable quality in terms of standard scientific criteria, with little data of good quality. We have developed an innovative approach to overcome this drawback. By combining good quality data with low quality data we have access to sufficient information to attempt to identify best practices.

COSMMA, A COLLABORATIVE DATABASE FOR MEASURING THE IMPACTS OF DECENTRALIZED ELECTRIFICATION

Mindful of the tremendous diversity of decentralized electrification projects, be it in terms of geographical context, technical characteristics, governance or the method used to evaluate projects, identifying best practices in this field is a complex task. It is only possible to draw lessons from these evaluations by systematically collating evaluations in a manner that codifies the information they contain within a harmonized framework that renders the information comparable.

This was the thinking behind the construction of CoSMMA. The database houses large quantities of information on decentralized electrification projects completed since 1980 in countries in development and transition. The data come from project evaluation documents published, for the most part, in scientific reviews. The data have all been checked and added to through a process of dialogue with authors. The database is not exhaustive, but representativity is ensured via systematic searches of referenced publication databases (Academic Search Premier, Business Source Complete, Econlit, GreenFILE). The first characteristic identified by the database is that the large majority of evaluations submitted rely on descriptive statistics or expert statements rather than on rigorous statistical tests. We need to treat what we term non-scientific evaluations with caution as they are not comparable with evaluations based on statistical tests, which we term scientific.

CoSMMA contains 403 evaluated projects. Any one project may have been evaluated from multiple angles, notably as regards topics that relate to the various Sustainable Development Goals. The most frequently reported effects correspond to SDG 7 on access to modern energy sources, but many evaluations consider effects linked to other SDGs, particularly the eradication of poverty (SDG 1), health (SDG 3), education (SDG 4), gender equality (SDG 5) and economic transformation (SDG 8). Certain effects tested also correspond to social and environmental improvements: community (SDG 11), environment (SDG 13) and security (SDG 16). Lastly, some of the observed effects do not particularly relate to the SDGs but can nonetheless be noteworthy, such as effects on allocation of time or access to information and communications. The database catalogs a total of 2,712 effects observed.

Owing to the widely dissimilar nature of effects examined by assessors, we consider all effects relevant in terms of providing information on the success or failure of a project. With our approach, a project is considered potentially successful if, and only if, it has led to significant economic, social or environmental uplift within the implementation area.

An effect is considered significant at the 5% threshold, where there is less than a 5% risk of mistakenly concluding this effect exists where it does not. These are what we term false positives, although this expression is potentially misleading in the context of our work because a false positive can also mean we are mistaken in concluding that a project effect is favorable or unfavorable. To evaluate a project we seek to identify whether it has had a favorable effect, and we translate the results obtained by constructing a 95% confidence interval for the true value of the effect. We do this by assuming that the usual estimators are bias-free and distribution is symmetrical, so that in the case of a significant effect on the 5% threshold there is only a 2.5% risk that an effect judged positive is in fact negative.

Table 1 shows how scientific attempts to test the impact of decentralized electrification projects have focused primarily on education and health, and access to energy to a lesser extent. In contrast, descriptive evaluations and expert assessments focus on access to energy, economic transformation and the environment.

TABLE 1: DISTRIBUTION OF EVALUATION DATA BY TYPE OF EFFECT

Type of effect Evaluation method	Scientific data	Non-scientific data
<i>SDG (SDG number)</i>		
Education (4)	205	144
Health (3)	174	139
Access to energy (7)	136	847
Economic transformation (8)	32	212
Income and living conditions (1)	30	61
Gender equality (5)	24	57
Safety (16)	21	35
Community (11)	1	81
Environment (13)	0	222
Other effects		
Allocation of time, leisure activity	51	31
Information and communications	38	53
Housework	34	15
Financial transformation	6	52
Migration	0	11
TOTAL	752	1,960

In terms of the technical characteristics of projects, we consider two primary factors: energy source and installation power. For these two factors, use of scientific data alone leads to sampling bias, with a very strong focus on low-power solar installations. These systems are primarily SHS, solar lanterns and public solar lighting. They have been subjects for research because they use a new technology that is affordable and easy to install. The complete CoSMMA database includes many other types of projects, using other energy sources and offering higher power. However, these types of projects have been scientifically evaluated far more infrequently (see tables 2 and 3), meaning it is hard to use these evaluations to draw generalizable lessons regarding best practices.

TABLE 2: DISTRIBUTION OF PROJECTS BY ENERGY SOURCE

Type of effect Evaluation method	Scientific data	Non-scientific data
Solar	59%	38%
Biomass	0%	20%
Hydroelectricity	12%	14%
Wind	0%	9%
Diesel and other	18%	8%
Renewable hybrid	0%	4%
Diesel hybrid	12%	4%
Geothermal	0%	2%
Renewable unspecified	0%	1%
TOTAL	100%	100%

In particular, scientific evaluations concentrate on nano systems to such an extent that this constitutes a major shortcoming in the existing literature on evaluation (Eales et al, 2018). This raises a problem, because we expect nano solutions to generate relatively few effects as the appliances they power are mostly electric lightbulbs and cellphone chargers, sometimes refrigerators or televisions, and only rarely electric motors.

TABLE 3: DISTRIBUTION OF PROJECTS BY POWER

Power Evaluation method	Scientific data	Non-scientific data
Nano: <1,000 W	71%	19%
Pico: 1 to 5 kW	0%	3%
Micro: 5 to 100 kW	18%	50%
Mini: 0.1 to 1 MW	6%	12%
Small: 1 to 10 MW	6%	17%
Large: 10 to 100 MW	0%	20%
TOTAL	100%	100%

Regarding project governance, evaluation documents provide little information because, until recently, questions of governance have rarely been covered in the literature. We usually know the decision-making level, making possible a discussion on the relative merits of top-down and bottom-up approaches. Thus, the characteristics of our scientific data sub-sample are not overly different from the other evaluations recorded in CoSMMA, as shown in Table 4, which presents project structures by decision-making level, from national to local.

TABLE 4: DISTRIBUTION OF PROJECTS BY GOVERNANCE MODE

Governance Evaluation method	Scientific data	Non-scientific data
Decision-making level		
National	59%	47%
Provincial	12%	24%
County	1%	18%
Local & district	28%	12%
TOTAL	100%	100%

EVALUATING THE SUCCESS OR FAILURE OF PROJECTS

CoSMMA contains few scientifically evaluated projects, and these projects constitute a sample with bias in several important areas: energy source, generator power, and the nature of the effects evaluated. It is not too great an exaggeration to say that scientific evaluations have mostly studied the effects of SHS-style nano solar projects on education and health.

This means that, in order to judge the success or failure of decentralized electrification projects, it is also necessary to use the results of non-scientific evaluations, while keeping in mind the limitations of these data. This difficulty is inherent to the problem of evaluating small-scale projects owing to the high fixed costs of scientific evaluation methods, which require examination of a sample group sufficiently large to be considered representative. That is without the even higher costs associated with drawing up randomly selected control groups, as recommended by Abhijit Banerjee, Esther Duflo and Michael Kremer, who were awarded the 2019 Nobel Prize for Economics for their work in this field.

The approach to resolving this difficulty that we propose is inspired by the empirical approach used by assessors, which consists of consolidating their conclusions by triangulating several independent observations of the same reality (Greene and McCormick, 1985). This approach is all the more appropriate to electrification projects insofar as, in the event of a successful project, favorable effects are expected in a very wide range of domains.

Let us imagine, for example, that an empirical observation makes it possible to note an increase in agricultural output following the arrival of electricity. This observation does not enable a precise conclusion to be drawn in the absence of a significance test, but it does tell us that we have a less than 50% chance of making a mistake if we conclude that the electrification project had a favorable effect on the socioeconomic situation. Let us now suppose that, independently, it is observed that children in the village are doing better at school. There is again a less than 50% chance of being mistaken if we conclude that the project has had a favorable effect. Combining these two independent

observations enables us to conclude that we have a less than 25% risk (50% \times 50%) of being mistaken if we conclude that the project has had a favorable effect on the socioeconomic situation in the village. If we have three independent observations of this type, there is a 12.5% probability of being mistaken in drawing this conclusion.

- This means that the accumulation of favorable independent observations makes it possible to rapidly validate the conclusion that the village's socioeconomic situation has seen significant uplift subsequent to deployment of the electrification project. This is the triangulation principle. To obtain qualitatively the same accuracy of conclusion as a favorability test with a 5% threshold value we need to combine between five and six favorable independent descriptive observations. This approach is not, however, without pitfalls, which must be identified if they are to be avoided.
- The observations used must be unbiased, which will usually be the case except where the assessor is manifestly not independent. The most commonly used descriptive statistical indicators, averages in particular, are in theory bias-free estimators. The various observations must also be independent, otherwise the probability of a mistaken conclusion of project success will be under-estimated. With decentralized electrification projects, the fact that projects potentially have effects in numerous independent domains is particularly helpful for the successful use of triangulation. Naturally, if we want to draw conclusions in a specific domain, such as poverty reduction or educational uplift, the available observations are less numerous and less diversified. For this reason, we essentially limit application of this method to the question of project success or failure, assigning the same weight to the various forms of effects that may be produced:
- Triangulation cannot be used to draw conclusions on causality. A situation may have improved for other reasons, possibly reasons that cannot be observed. With standard scientific approaches, it is this that leads to the recommendation to compare observed results against a randomly constructed control group. There is no control group, in the sense of non-electrified villages, in the CoSMMA database, but we can compare a project to other projects. This does not allow us to conclude that providing electricity has a positive causal effect (impact) on socioeconomic uplift, but that is not the essential issue for promoters of these projects. However, it is possible to compare projects against each other, and thereby to identify best practices (see the following section).

In the CoSMMA database, we observe that projects have unfavorable effects in certain domains. For example, a biomass-based project might create land-use pressures that lead to a degraded environment and social tensions surrounding access to land. Unfavorable effects such as this do not necessarily mean the project is a failure. However, to take account of them we will then consider whether a project has succeeded if, and only if, observations of significant favorable effects outweigh observations of significant unfavorable effects.

Application of this triangulation method allows us to significantly increase the number of projects whose success or failure we are able to judge. If we consider only those subject to

a scientific evaluation, there are just 17 projects available in the CoSMMA database, 75% of which can be considered a success. If we triangulate using five observed effects as a threshold value, we then have 125 projects, with slightly under 80% of them considered a success. The number falls to 108 projects if the triangulation threshold is six observed effects, although the proportion of successful projects is unchanged.

The relatively high proportion of projects judged a success should be relativized as a function of the elapsed time between deploying the installations and observing the effects of a project. A project can appear to have succeeded in the short term but prove unsustainable in the longer term. We do not always know the date that observations were made, but we do have an indication based on the date that the evaluation was published, in the knowledge that there is an average lapse of 2.5 years between the date effects were observed (when this is available) and the date of publication. According to our evaluation by triangulation, project success rates fall to 70% where the publication occurs after 12-13 years, i.e., an evaluation delay of around 10 years.

IDENTIFYING BEST PRACTICES

In order to identify best practices, we look at which project characteristics are most commonly associated with success.

We use an approach that is statistical rather than purely descriptive. For example, we observe that projects evaluated by triangulation are more often judged a success than those evaluated using scientific data (80% versus 75%), but we want to know if this difference is significant, i.e., whether we run a large risk of being mistaken if we conclude this discrepancy is negligible. To do this, we use a standard econometric method called probit, which involves evaluating whether the probability of observing a success correlates in a significant manner, in our example, to the fact that the conclusion of success is obtained by triangulation rather than scientific data.

This method also offers the advantage of permitting a multi-factor evaluation from the outset, by combining various characteristics of interest. When there is a partial positive correlation between characteristics (for example, a solar project is most commonly nano sized), a single-factor analysis would risk biasing attribution of a favorable result on the basis of a specific characteristic.

The results are summarized in Table 5. The table indicates, in each row, the reported parameters that correspond to the average marginal effect¹ of the characteristics on the probability that a project will be a success, with the *symbol indicating if the parameters are significant (**for a 1% threshold, **for 5% and *for 10%). The columns present various alternative specifications.

TABLE 5: DETERMINANTS FOR PROJECT SUCCESS

	[1]	[2]	[3]	[4]
	5-factor triangulation	6-factor triangulation		
			(with interaction between nano and eval. delay)	(with RISE off-grid)
Scientific data	-0.162	-0.137	-0.172	0.108
Evaluation delay (eval. delay)	-0.013**	-0.012**	-0.006	0.001
Energy source (ref. = solar)				
Wind	-0.207	-0.339	-0.321	..
Geothermal
Hydro	0.168**	0.106	0.093	..
Diesel hybrid	-0.031
Renewable hybrid	0.102	-0.024	-0.043	-0.029
Biomass	0.071	0.002	-0.003	-0.092
Not known	0.122	0.065	0.031	..
Diesel	-0.373**	-0.339**	-0.356**	-0.154
Power < 1 kW (nano)	0.091	0.025	0.159	0.089
Nano * eval. delay			-0.015*	-0.019**
Decision-making level (ref. = local)				
Province/county	-0.048	-0.254**	-0.228*	-0.442***
National	-0.069	-0.146	-0.124	-0.110*
RISE off-grid				0.005***
No. observations	115	95	95	51
Pseudo R2	0.16	0.22	0.23	0.35

Probit estimate with clusters per country - .. parameter cannot be estimated - *** (resp. **, *) significant at 1% threshold value (resp. 5%, 10%)

¹ Average marginal effect is the effect on the probability of success of a small variation in the studied variable, calculated at the average point of the data sample. In the case of a 0-1 category variable, the average marginal effect is the effect on the probability of success of the passage from modality 0 to modality 1, calculated at the average point of the sample.

The first variable of interest considered is the evaluation method used to decide whether or not a project is a success, using scientific data or triangulation where this is unavailable. When we use 5-factor triangulation, this appears markedly more optimistic than the scientific evaluations. Projects evaluated with scientific data have a 16% lower chance of being judged a success than projects evaluated using triangulation, and this parameter is almost significant at a 10% threshold value (it is with a threshold value of 12%). This might bias our results for the identification of best practices. To test the robustness of the results, in the second column of the table we enter results obtained using 6-factor triangulation, where the difference with scientific data is smaller and less significant. For this reason we prefer to base our conclusions on this second estimate in the event of divergence with the first estimate, albeit at the cost of reducing the number of available observations. There are around 20 projects in CoSMMA for which we have five non-scientific evaluations of the effects, which have been subjected to 5-factor triangulation but cannot be subjected to 6-factor triangulation.

In both cases, the evaluation delay (evaluation publication year minus deployment year) significantly reduces the probability of obtaining a favorable effect. Our interpretation of this result is that, even if many projects have a positive effect in the short to medium term, they are not always successful over the long term, which points to a problem of sustainability. Sustainability problems have often been cited in studies of decentralized electrification projects (Feron, 2016; Roche and Blanchard, 2018; Katre et al., 2019). Poor sustainability is often associated with problems in the maintenance of installations.

Project technical characteristics are then considered in terms of two primary factors: primary energy source and generator power.

Regarding the primary energy source, we use solar as our reference because it is the most commonly used. The use of diesel generators gives significantly fewer favorable results than solar panels. Generators using other renewable primary sources, including hybrid systems, do not appear to differ

from solar installations. This is doubtless because relatively few projects have been analyzed, making it impossible to obtain more precise results. This means that hydroelectric systems, known for their technological simplicity and low cost, score better than solar systems in the sample using

5-factor triangulation, but not in the smaller 6-factor triangulation sample.

We test the effect of generator power by comparing nano systems (capacity under 1 kW) with higher power systems. In the sample with 5-factor triangulation, nano systems exhibit more favorable effects than other systems, but this parameter is not significant and is considerably lower when examining a 6-factor triangulation sample.

The evaluation approach is inspired by the empirical approach used by assessors, which consists of consolidating their conclusions by triangulating several independent observations of the same reality

The variations in the effect of power revealed by these results can partly be explained as an interaction with evaluation delay, as shown in the third column of Table 5. Power increases the probability of success for a project where the delay between commissioning and observation of effects is around 7.5 years or longer. Nano projects are less sustainable than higher power projects.

A descriptive analysis by type of effect also illustrates the variation in effects according to generator power (Table 6). Smaller sizes can have more favorable effects in terms of providing access to modern energy sources owing to the simplicity of the systems deployed. Similarly, favorable societal and environmental effects are more frequent among projects relying on lower power systems: we observe favorable effects relating to access to public lighting or meeting places, which are not dependent on the level of power, whereas environmental benefits can be offset by pressure on natural resources exerted by higher power installations. We also see greater risks of conflict surrounding the allocation of power with higher power systems. Conversely, nano systems are markedly less favorable in terms of economic transformation and increased earnings. This may explain why they are less sustainable in the long term: production of economic benefits reinforces the willingness and ability of a project's beneficiaries to pay the maintenance costs required to ensure the sustainability of the installation.

TABLE 6: PROPORTION OF SUCCESS BY TYPE OF EFFECT AND POWER

Type of effect	5-factor triangulation		6-factor triangulation	
Power	nano	> nano	nano	> nano
Access to energy	69%	58%	71%	52%
Individual wellbeing	88%	92%	88%	88%
Income and economic transformation	64%	100%	58%	80%
Community wellbeing	63%	50%	80%	40%

Aside from the technical aspects, the primary factors that can influence the success of projects seeking to produce local public services tend to center on governance. Mindful of the local nature of these projects, the first question that arises is what is the most appropriate decision-making level? Traditionally, a difference is made between top-down approaches, where decisions are taken centrally, and bottom-up approaches, where decisions are taken by an authority at the local level (Tenenbaum et al., 2014).

Theoretical works, notably as initiated by Ostrom (1999), advocate the bottom-up approach. Ostrom shows how problems in collective actions caused by the free-riding phenomenon are better when managed locally than centrally. This applies to mini-grids (Berthelemy, 2016).

However, a project's decision-making level may have different types of consequences in practice. On one hand, a project decided on locally may take better account of local people's needs; it may also be rooted in a governance structure that is keen to promote cooperative management of resources. On the other hand, projects decided on at the national level may benefit from a greater degree of expertise, experience and future-proofing. Economies of scale in the accumulation of knowledge and greater skill levels may help to identify, at least from a technical point of view, solutions that are the most efficient.

There is no obvious answer to the question of choosing between the two approaches, top-down or bottom-up; it remains an empirical question. Our results, however, show that locally decided projects succeed better than others. In our estimates based on data from a 6-factor triangulation, we also note the appearance of a V-shaped effect curve, indicating that projects decided at intermediate administrative levels (province, county) are the least successful. The V-shaped curve illustrates the fact that there are arguments in favor of top-down as well as bottom-up.

Aside from this choice, the quality of governance methods can be highly variable at both the national and local levels.

Our data do not allow examination of the question of local governance, which is without doubt important. There is a need to study the principles developed by Ostrom for designing governance methods suited to stimulating good cooperation between local actors for management of the commons (Gollwitzer et al., 2018).

Aside from the technical aspects, the primary factors that can influence the success of projects seeking to produce local public services tend to center on governance

We can, however, examine questions of governance at the national level. The electricity sector is highly regulated and regulators such as rural electrification agencies, in the case of decentralized electrification, can act to facilitate or hinder the success of projects.

Sustainable Energy for All (SE4All) and the World Bank have collated the available information on institutional frameworks for access to energy policies in a database known as RISE (Regulatory Indicators for Sustainable Energy). The most recent available ESMAP synthesis (2018) concludes that regulatory and incentive policies have a major role to play. We fed all this data into CoSMMA to explore these questions within the specific context of off-grid electrification.

The RISE database lists five criteria concerning off-grid electrification: existence of a national program, existence of a legal framework, ability of operators to incorporate costs into tariffs, financial incentives and technical standards. The average of these five criteria provides an indicator, standardized from 0 to 100, of the quality of the institutional framework in the decentralized electrification sector, which we have termed RISE off-grid.

We introduce the RISE off-grid indicator as an explanatory variable for the probability that a project will succeed (column 4 in Table 5). Owing to data missing from RISE we lose several observations, which limits our ability to simultaneously evaluate the role of the choice of primary energy source (several sources have only a very small number of observations, all positive, which prevents them from being taken into account). Despite the limited number of observations, this equation shows the very significant positive effect of

the quality of national sector governance. This effect is also highly sensitive: on average, a 1% improvement in this indicator translates to a 0.5% increase in project success. This result confirms the important role that governance plays in the success of projects.

CONCLUSION

The weakness of evaluation systems is a major obstacle to the development of essential services in rural areas, including decentralized electrification. Using scientific methods to evaluate development projects of this nature is extremely costly owing to the small size of these isolated projects, with the upshot that we do not have irrefutable proof of the soundness of such projects, nor the means to identify best practices in the matter.

FERDI has gathered a large number of evaluations of electrification projects in the CoSMMA database, making it possible to confirm how few scientific evaluations there are, which in any event concentrate on SHS and the effects on education and health. This makes it impossible to draw conclusions on mini- or micro-grids or on other important effects surrounding, for example, economic transformation or environmental protection.

We propose a new method that makes it possible to use these data despite this, by exploiting a portion of the non-scientific evaluations via a triangulation method.

This approach makes it possible to evaluate the success of the projects listed, which runs at an average of around 80%, but falls to 70% five years after installations are commissioned, pointing to a problem of sustainability that practitioners have observed time and time again.

The method has also enabled us to highlight the following elements of best practice.

- Solar projects are more efficient than those that use diesel generators. On the other hand, we have insufficient evidence of differences in efficiency between solar projects and projects using other renewable resources.
- Nano-sized projects are efficient in the short term but are less sustainable than projects offering more power, such as mini-grids. This might be explained by the fact that lower power systems are not suited to uses that deliver economic transformation and increase users' incomes, in turn reducing their ability and motivation to pay. But it is important to take account of the potentially negative societal and environmental effects of larger-scale projects.
- Project governance is a key determining factor in their degree of success. Bottom-up approaches tend to be the most efficient. It is, however, necessary to take account of interactions between the local and national levels, a fact confirmed by the influence that the quality of sectoral regulation has on the success of projects. Unfortunately the available data do not allow an exploration of local governance methods, which must inevitably play a prominent role in bottom-up approaches.

This points to twin directions for complementary research: the development of low-cost evaluation methods based on the triangulation principle; and explorations of the characteristics of project governance methods at the local level.

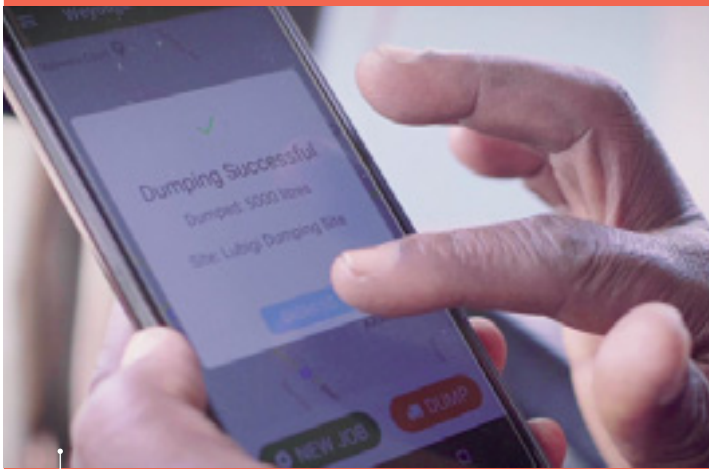
REFERENCES

- Berthélemy, Jean-Claude. *Mini-grids as an application of Elinor Ostrom's theses on polycentric governance as a way to cope with the tragedy of the commons*. Revue d'économie du développement, 2016, vol. 24, no 3, p. 85-106
- Eales, Aran, Walley, Luke, Buckland, Hannah, et al. *Social impacts of mini-grids: towards an evaluation methodology*. 2018 IEEE PES/IAS PowerAfrica. IEEE, 2018. p. 354-359
- ESMAP. *Policy Matters: Regulatory Indicators for Sustainable Energy (RISE)*. Washington, D.C., World Bank Group, 2018
- Feron, Sarah. *Sustainability of off-grid photovoltaic systems for rural electrification in developing countries: a review*. Sustainability, 2016, vol.8, no. 12, p.1326
- Greene, Jennifer, and McClintock, Charles. *Triangulation in Evaluation: Design and Analysis Issues*. Evaluation Review, 1985, vol. 9, no 5, p. 523-545
- Gollwitzer, Lorenz, Ockwell, David, Muok, Ben, et al. *Rethinking the sustainability and institutional governance of electricity access and mini-grids: electricity as a common pool resource*. Energy Research & Social Science, 2018, vol. 39, p. 152-161
- Katre, Aparna, Tozzi, Arianna and Bhattacharyya, Subhes. *Sustainability of community-owned mini-grids: evidence from India*. Energy, Sustainability and Society, 2019, vol. 9, no 1, p. 2
- Ostrom, Elinor. *Coping with tragedies of the commons*. Annual review of political science, 1999, vol. 2, no 1, p. 49
- Tenenbaum, Bernard, Greacan, Chris, Syanbalapitiya, Tilak, and Knuckles, James. *From the bottom up: how small power producers and mini-grids can deliver electrification and sustainable energy in Africa*. Washington D.C., World Bank Group, 2014

DIGITAL SOLUTIONS TO IMPROVE BASIC SERVICE PROVISION TO THE URBAN POOR

George Kibala Bauer

Advocacy Manager for the Mobile for Development Utilities programme, GSMA



@GSMA

George Kibala Bauer is Advocacy Manager for the GSMA Mobile for Development Utilities programme, which seeks to improve the provision of essential services in developing countries through mobile technology. His responsibilities include building strategic partnerships, and generating insights – particularly on urban service provision in the context of rapid urbanisation. George holds an MSc in International Economic Policy from Sciences Po Paris.

Africa's urban population is expected to double from now until 2050, while most of this growth will be concentrated in informal settlements, where over 63 per cent of the urban population in least-developed countries already live. This poses challenges to basic service provision as cities struggle to meet the demands of rapidly growing urban populations. Unless city authorities and utilities find innovative ways to include informal settlements in service provision, water shortages, lack of sanitation, unreliable power and insufficient waste management will remain a reality for most of the urban poor. As COVID-19 demonstrates, the reliability and inclusivity of basic services is a critical determinant of societies' resilience in the face of external shocks.

Mobile-enabled digital solutions are uniquely placed to address these challenges. The expansion of mobile connectivity in developing countries has enabled the proliferation of digital solutions that can make essential services more accessible and affordable. For instance, the spread of mobile money throughout Africa, is enabling innovative business models like pay-as-you-go (PAYG) to make vital services accessible to low-income populations.

Innovations like smart metering, PAYG, big data, GIS and the Internet of Things (IoT) can be applied to a range of impactful use cases, such as deploying smart grids, coordinating sanitation services, monitoring water pipe leakages, mitigating peak traffic flow or managing waste flows.

This section explores the potential for these mobile-enabled innovations to provide solutions to pressing challenges facing the urban poor.

INTRODUCTION

The pace of urbanisation in Africa is unprecedented. Lagos' population will grow by the entire population of Rotterdam (600,000) every year from now until 2030, while Kinshasa's population is likely to almost double in the next 15 years. Africapolis, a geospatial database on cities and urbanisation dynamics in Africa developed by the OECD, projects that by 2050, Africa's cities will be home to an additional 1 billion people¹. This growth will not only take place in well-known metropolis such as Lagos or Kinshasa, but also lesser known cities such as Onitsha and Mbuyi-Mayi, which are among the 30 fastest growing cities in the world².

Yet, urbanisation in Africa is generally not associated with structural transformation. Compounding this, informal settlements, where according to the World Bank 63 per cent of the urban population in least-developed countries already live, will likely absorb the bulk of urban population growth. For city authorities, and utilities struggling to meet the demands of rapidly growing populations, this poses unique challenges.

¹ OECD (2020), Africapolis

² GSMA (2020), Digital Solutions for the Urban Poor

Urbanisation without structural transformation has important implications for a city's built environment and its ability to provide basic services to its population. Since the urban poor cannot afford to live in well-connected neighbourhoods with high-rise apartments, many African cities are characterised by low-rise informal housing and urban sprawl. For city authorities and state-owned utilities providing basic public services, urban sprawl poses unique challenges. Under intense financial stress, many cities are struggling to address an affordability-coverage gap. Most have to juggle demonstrating their financial viability to the central government or investors with mobilising substantial investments to extend and improve basic service provision to the urban poor.

The financing challenge that cities face is often compounded by precarious property rights, regulatory ambiguity and unplanned and informal housing that define many informal urban settlements. The capital expenditure required to provide basic infrastructure, such as water pipes or sewer networks, is significantly greater in the context of informal settlements³. The result is often highly disproportionate distribution of basic services between richer neighbourhoods and poorer informal settlements, with preference given to the socio-economic core. This has had profound implications for development:

- In 11 out of 39 Sub-Saharan African countries, access to at least basic water services for the urban poor (i.e. the bottom 20 per cent in the income distribution) has actually decreased. The impact is evident in Lagos, Nigeria, for example, where the private water tanker has quadrupled over the last decade.
- In cities throughout Nigeria, at least 22 million small gasoline generators are being used on a daily basis to power households and small businesses that can't rely on the national grid for power⁴.
- Between 2000 and 2015, in most African countries, growth in sewer access did not keep up with urban population growth. In Malawi, only 21 per cent of the urban poor (bottom 20 per cent) have access to at least basic sanitation, while 74 per cent in the top income quintile (top 20 per cent) have access.

Climate change is intensifying these challenges and creating an urgent need for cities to be resilient to sudden shocks, to adapt to rapidly changing circumstances and be responsive to uncertainties, risks and vulnerabilities. Unless city authorities and utilities find innovative ways to include informal settlements in service provision, water shortages, lack of sanitation, unreliable power and insufficient waste management will remain a daily reality for most of the urban poor. For cities in developing countries to become true engines of productivity, both public and private sector stakeholders

must address the challenges of the urban poor and ensure that cities work for all.

The GSMA representing mobile operators worldwide, and its Mobile for Development team, which drives innovation in digital technology to reduce inequalities, are committed to helping governments, city authorities, and innovators address these challenges in order to contribute to more inclusive urban futures across Africa.

HOW DIGITAL SOLUTIONS CAN IMPROVE URBAN SERVICE DELIVERY

The expansion of mobile connectivity and mobile-enabled innovations throughout developing countries has enabled the proliferation of digital solutions that are making vital basic services, such as energy, water, sanitation, and waste management, more efficient, accessible and affordable. In Sub-Saharan Africa, the total number of unique mobile connections exceeds 456 million⁵, and is projected to grow to 623 million by 2025.

The spread of mobile money throughout Sub-Saharan Africa, has been a key enabler of digital payments and financial inclusion. As of 2019, there were over 181 million active mobile money accounts making transactions worth USD 456.3bn a year⁶. Mobile money has been vital to digital innovations across Africa and

Asia and allowed many organisations, startups in particular, to develop solutions tailored to the realities of consumers living in these parts of the world.

According to the 2019 GSMA Mobile Internet Connectivity Report, urban populations in low- and middle-income countries (LMICs) are 40 per cent more likely than their rural counterparts to use mobile internet. This is driven in part by smartphones becoming more affordable, particularly in Sub-Saharan Africa, and rising digital literacy, particularly in urban areas. Between 2014 and 2018, the penetration of smartphone connections in Sub-Saharan Africa increased from 10 per cent to 30 per cent, as several Asian hardware makers tailored their product offerings to this vast underserved consumer market. The number of smartphone connections in the region reached 302 million in 2018; this will rise to nearly 700 million by 2025, an adoption rate of 66 per cent⁷. As smartphone penetration continues to accelerate, a growing number of people will be able to take advantage of more sophisticated digital use cases.

GSMA identifies five technological innovations in different sectors that can scale and reduce operational expenses of vital service provision, while also reaching low-income communities (Figure 1). Digital solutions, such as PAYG, GIS

Unless city authorities and utilities find innovative ways to include informal settlements in service provision, water shortages, lack of sanitation, unreliable power and insufficient waste management will remain a daily reality for most of the urban poor

3 Collier and Venables, Urban infrastructure for development (2016)

4 Access to Energy Institute and Dalberg (2019), Putting an End to Nigeria's Generator Crisis: The Path Forward.

5 GSMA (2019), GSMA Mobile Economy Report Sub-Saharan Africa

6 GSMA (2019), State of the Industry Report on Mobile Money.

7 GSMA (2019), State Of Mobile Internet Connectivity Report.



Coliba, a waste management company to ease recycling - @GSMA

tracking, smart metering, big data analytics and IoT platforms, offer new opportunities to tackle complex challenges. They can support tailored, cost-effective solutions, that bring

operational efficiencies, expand services to the poor, and bring transparency and coordination across a range of public, private, and civic stakeholders.

Figure 1: How digital solutions support inclusive urban service delivery

Solution	Relevance	Use cases
Pay-as-you-go	More affordable services for poor consumers because they can make micropayments; service providers improve revenue collection in informal settlements	On- and off-grid energy, water, sanitation, and clean cooking services; 4.2 million solar home systems were sold on a PAYG basis in the last two years alone ⁸
GIS tracking	Many cities lack granular data on the delivery of basic services, which often relies on the coordination of multiple stakeholders across complex value chains	Facilitating safe transport and disposal of fecal sludge; geolocating sanitation facilities and customers and site planning for expanding system capacity
Smart metering	Automatic meter reading records consumption and key operational data	Smart meters for energy and water services to give accurate real-time information to service providers and customers
IoT/M2M connectivity	Smart monitoring of systems, which can increase operational efficiency	Water point monitoring to assure functionality; smart grids to reduce technical and commercial losses
Big data	Large data sets enable better understanding of the daily activities of the urban poor, which can facilitate evidence-based policymaking, inform entrepreneurs and unlock private investment	Peak traffic management; forecasting for disaster resilience, and urban expansion

Source : GSMA

8 GOGA (2020)

TACKLING CHALLENGES WITH TECHNOLOGY: HOW INNOVATORS ARE IMPROVING CONDITIONS FOR THE URBAN POOR

Through its Mobile for Development Utilities and Ecosystem Accelerator Innovation Fund, GSMA provides grant funding to different mobile-enabled innovations to make basic services more affordable and more reliable to the urban poor.

Focusing on access to energy and clean cooking, water, sanitation, and waste-management, these five case studies highlight the potential of mobile-enabled innovations to improve basic service provision in the context of rapid urbanisation:

CIRCLE GAS – PAY-AS-YOU-GO CLEAN COOKING IN DAR ES SALAAM AND NAIROBI



@GSMA

PROBLEM:

Population growth is outpacing the number of people gaining access to clean cooking by four times, with estimates suggesting that 2.2 billion people will still not have access by 2030 if current trends continue. The Clean Cooking Alliance estimates \$4 billion is required annually to ensure universal access to cleaner cooking options, such as electric, ethanol, biomass pellet stoves or liquefied petroleum gas (LPG) by 2030. Household pollution generated from diesel generators, as well as polluting cooking materials like charcoal, are major causes of death and have profoundly adverse implications for long-term health outcomes and economic growth. In Tanzania, over 90 per cent⁹ of the country's 57 million people use solid fuels, such as charcoal and wood, as their main source of energy for cooking. This has detrimental effects on the safety and respiratory health of families and the country's environment.

SOLUTION:

Circle Gas, recently acquired KOPAGAS' technology that provides PAYG clean cooking solutions for families in the last mile in developing countries. KOPAGAS began their business through collaboration with Oryx Tanzania, and mobile operators Vodacom and Airtel Tanzania, by offering a cost-effective meter and Pay-As-You-Cook™ gas service, allowing

users to track their consumption and make mobile payments in small instalments through their mobile money accounts. The solution incorporates IoT and M2M appliances to collect usage data and relay information to users, such as reminders to charge the smart meter battery or alerts that the cylinder is empty and in need of replacement.

In Tanzania, 32 per cent of Circle Gas' customer base lives below the relative poverty line of \$3.10/day, with most not making more than \$5.50/day. The vast majority of its customers are female. As of August 2019, the appliances and PAYG service have reached over 117,000 people and 3,500 households across Tanzania. The upfront LPG cooking kit fee of \$6.50 and an average cost of \$0.45 per day provides an affordable alternative to traditional and expensive LPG canisters that typically require an upfront investment of \$60–100¹⁰. PAYG is making clean cooking via LPG attainable for Dar es Salaam's urban poor. 61 per cent of Circle Gas' customers said their monthly spending on fuel has "slightly" or "very much" decreased since using the service.

LOOKING AHEAD:

In January 2020, Circle Gas Limited acquired KOPAGAS in a transaction worth USD 25 million. The acquisition, thought to be the largest ever pure private equity investments in the clean cooking technology sector, will accelerate the scale-up of smart metered LPG, expanding the existing business in Tanzania and Kenya in 2020. Safaricom, Kenya's largest mobile operator, is also an investor in Circle Gas and has an operating agreement with the Circle Gas Kenyan subsidiary M-GAS, which will run the PAYG LPG business in Nairobi, Kenya. The M-Gas solution will run on Safaricom's Narrow Band Internet of Things (NB-IoT) network that provides low-power mobile connectivity, as well as leverage the operator's mobile money service, marketing, and customer service. This is the first time a mobile operator has invested in clean cooking solutions, recognising the commercial opportunity of mobile enabled utility services.

⁹ WHO, (2018)

¹⁰ GSMA (2018), KopaGas: Mobile-enabled Pay-as-you-Cook service in Tanzania.

LUMOS – PAY-AS-YOU-GO SOLAR HOME SYSTEMS IN NIGERIA'S CITIES



@GSMA

PROBLEM:

Several African cities still have a wide energy access gap. At least 110 million of the 600 million people without access to electricity in Africa today live in urban areas¹¹. Estimates for the proportion of 'under-the-grid' populations, communities living near existing power lines or even directly under the transmission lines, that do not have access to the national grid range from 61 to 78 per cent. Even when customers have grid connections, they are not necessarily guaranteed consistent energy access. In Nigeria, chronic grid outages have made power unreliable to those connected to the national grid¹². Blackouts significantly dampen economic growth and private sector development, as businesses must constantly adapt and invest in costly alternative energy sources, such as diesel generators.

Nigeria has the largest urban off-grid market globally, and this has given rise to an unprecedented proliferation of diesel generators. According to a recently released study by the Access to Energy Institute and Dalberg, at least 22 million small gasoline generators are being used to power households and small businesses on a daily basis. Excessive expenditures for back-up electricity (such as diesel generators) prevent small business owners from investing in their businesses by costing them up to 30 per cent of average monthly revenues.

SOLUTION:

Lumos Global offers a clean, reliable and affordable solar energy solution for people and businesses living off the electricity grid. Its solar home system is an 80W solar panel unit and cable, and includes a control unit with eight sockets, a USB mobile adapter and two LED

bulbs, allowing users to convert solar power into clean electricity. Lumos has rolled out its solution as part of a branding and marketing partnership with MTN Nigeria, allowing it to take advantage of MTN's infrastructure with multiple stores across Nigerian cities, as well as its brand recognition. The solar system is mobile-enabled through the use of airtime credit and GSM-based M2M connectivity, which allows people to purchase the system over time through instalments.

To date, Lumos has over 100,000 customers in Nigeria alone, with 60 per cent of users located in urban or peri-urban areas. The company identified these areas as key drivers of future growth, as it positions its innovative solar home system (SHS) offering as a cleaner and more efficient alternative to widely used diesel generators.

LOOKING AHEAD:

Lumos was awarded a \$75 million grant by the Nigerian government to support its expansion and provide an affordable and clean solution to the country's chronic energy deficit. Lumos is aiming to sell five million solar home systems in the next three years and plans to expand its service offerings to meet the needs of different markets and the socio-economic status of its users, particularly the urban poor. In the context of COVID-19, Lumos was one of four companies that has been selected to receive a share of the \$500,000 Solar Relief Fund from Nigerian off-grid energy impact investing company All On. This new funding will enable Lumos to leverage its country-wide operations and logistics network to deploy solar home systems critical healthcare and emergency response centres across Nigeria.

¹¹ Shirley (2018), Millions of urban Africans still don't have electricity: here's what can be done.

¹² Quartz Africa (2018), The cost of electricity shortages in Africa is more than just a problem of access.

WONDERKID – MOBILE-ENABLED CUSTOMER CARE AND BILLING FOR WATER UTILITIES ACROSS AFRICA

PROBLEM: Although the urban poor are more likely to have access to basic or safely managed water than those in rural areas, the growth of informal settlements and the associated spread of untreated wastewater combined with the rise of climate change-associated water scarcity, pose unique challenges for utility service providers to include and serve the urban poor. In Sub-Saharan Africa, just under 25 per cent of urban households have access to piped water¹³. According to the International Water Management Institute, urban water demand will increase by 80 per cent between now and 2050. By then, nearly 5.7 billion people will face water scarcity for at least one month every year¹⁴.

The National Development Plan of Kenya seeks to make basic water and sanitation available to all by 2030. Currently, just over 59 per cent of Kenyans have access to at least basic water services¹⁵. Kenyan water utilities lose 30 to 85 per cent of their revenues due to commercial or infrastructure problems.

SOLUTION: Wonderkid is a software development consultancy based in Kenya. They develop bespoke solutions for the public and private sector across Africa. They started working in the water sector in 2012 with the launch of MajiVoice, a customer feedback and complaint management system for water utilities and their customers. Wonderkid also developed a mobile app for meter readers that allows meters to be photographed and customer accounts to be digitally updated, helping to address disputes and verify meter readers' activities in real-time. A self-meter reading and payment system also allows users to send their own meter reading via SMS and receive a preliminary bill with instructions for paying via mobile money using Safaricom's M-Pesa. KIWASCO, a water utility that uses the tools, recorded a 28 per cent increase in revenue collected and an 8 per cent increase in revenue billed. The average complaint resolution time dropped from more than 15 days to 6 days. The number of mobile money transactions to pay water bills increased by 71 per cent and there was a 50 per cent increase in the value of transactions.

LOOKING AHEAD: As of June 2020, Wonderkid is serving over 32 water utilities across Africa. In the coming years, Wonderkid seeks to diversify its revenue streams by leveraging its experience of working with water utilities. It also aims to pay more attention to the growing concern of water scarcity facing several water utilities in Africa, which makes reducing non-revenue water and improving revenue collection even more important.

SOMA MITA
by
Kisumu Water and Sewerage Company LTD

To Read your Meter, Please do the following

STEP 1

Please Send the **Black Digits** ONLY from your meter

0 1 2 5 6 0 1 5

To: 20880
Message: Kiwasco 07000001234 0125

Account Number Reading

STEP 2

You will receive SMS from us with your provisional bill and you can pay via MPESA Paybill No 517000

Terms & Conditions Apply

1. SMS to 20880 is FREE
2. You can only send your reading once a month

For more information, call us on 0721757382

@GSMA

¹³ World Bank (2019), Which Way to Livable and Productive Cities.

¹⁴ World Resources Institute (2019), Unaffordable and Undrinkable: Rethinking Urban Water Access in the Global South.

¹⁵ WHO, JMP and UNICEF (2017), JMP.

KCCA – IMPROVING URBAN SANITATION SERVICES IN KAMPALA THROUGH A GIS-ENABLED APP



@GSMA

PROBLEM:

According to the JMP (WHO/UNICEF), only 34 per cent of people living in least developed countries have access to at least basic sanitation services. Providing sewer access to informal settlements is proving particularly challenging given that sanitation service provision is often not a political priority and demands a high level of funding, sophisticated planning and engineering.

Sanitation services are under particular pressure in Kampala, with 94 per cent of the city relying on non-sewered sanitation. Often the only alternative, a decentralised system of pit latrines and septic tanks, is used by 70 per cent of the city's population, most of whom live in informal settlements. Without formal collection and treatment services available, these pits and tanks are emptied haphazardly by independent emptiers who may dump the waste illegally into the environment, risking the spread of cholera, typhoid and other water-borne diseases.

SOLUTION:

The Kampala Capital City Authority (KCCA) is the corporate and governing body of Kampala. In response to the challenge of delivering sanitation services to Kampala's urban poor, KCCA launched a GIS-based mobile app that links pit emptiers with customers. KCCA receives pit emptying jobs from customers through its call centre, connecting customers with the nearest pit emptiers. After completing an emptying job, the pit emptiers submit critical data through the app to KCCA, including customer details, the amount paid, volume emptied and the type and location of the sanitation facility.

The app serves as an 'ecosystem catalyst' by connecting customers with sanitation services and helping to ensure safe faecal sludge disposal for a cleaner and healthier city.

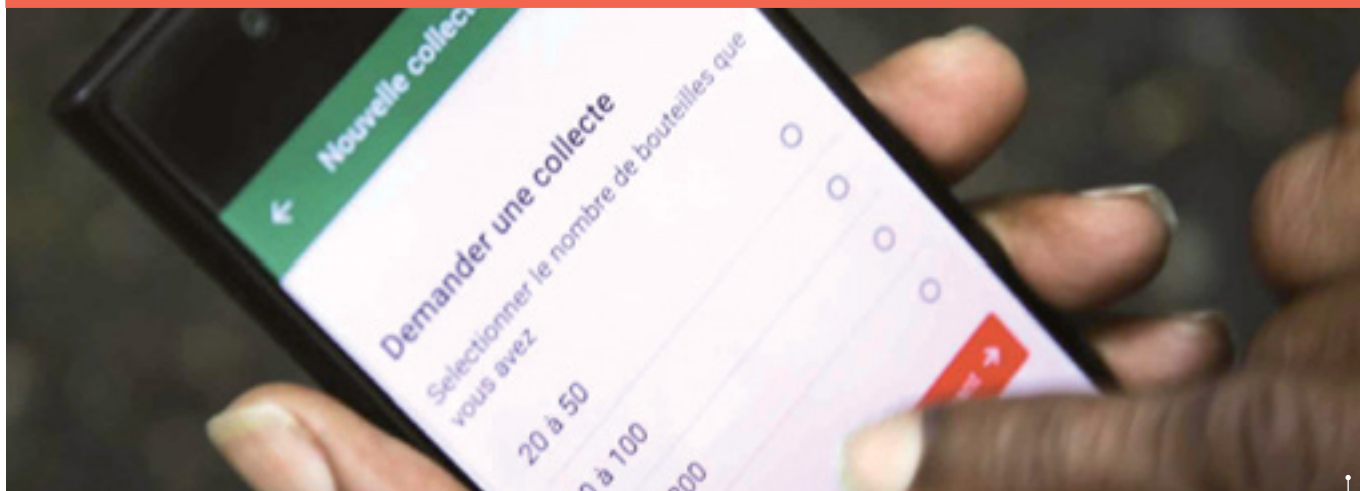
The platform enables KCCA to map sanitation activities across the city, which allows them to monitor and regulate service delivery and identify locations in need of more treatment capacity. KCCA has also worked with MTN Uganda to promote mobile money as a tool for pit emptiers to collect payments from customers and pay dumping fees at the waste treatment facilities.

As of January 2020, the solution has mapped over 171,000 sanitation facilities and facilitated over 5,000 pit-emptying jobs, improving overall sanitation in the city and building the capacity of pit-emptying entrepreneurs. Those using the app reported a 63 per cent increase in income and 71 per cent reported finding the app user friendly. Overall, 85 per cent of pit emptiers reported using the app regularly. Meanwhile, according to surveyed users, the project resulted in an 87 per cent reduction in illicit disposal of faecal sludge in the communities and a 70 per cent perceived reduction in disease outbreaks.

LOOKING AHEAD:

KCCA is in discussions with other municipalities (such as Mityana, Mbarara, Mukono and Wakiso) in Uganda to scale the service and improve sanitation service delivery in these regions. Their existing solution is also being scaled up to expand on other urban challenges such as solid waste management to improve garbage collection and disposal in Kampala.

COLIBA – FACILITATING RECYCLING THROUGH MOBILE TECHNOLOGY IN ABIDJAN



@GSMA

PROBLEM:

According to the World Bank, 93 per cent of waste in low-income countries is left in open dumps and there are normally no processing facilities. As solid waste treatment usually falls under the authority of local governments, limited financial resources and technical capacity are critical barriers to addressing this critical issue. However, waste generation is positively correlated with economic growth and is projected to grow significantly across developing countries. Excluding India and China, Sub-Saharan Africa will be the largest waste-generating region by 2050.

In Abidjan, over 288 tonnes of plastic waste are produced every day, less than five per cent of which is recycled¹⁶. Plastic is filling up the streets and waste is blocking drainage and sewerage systems, contributing to ecological degradation and pollution of water reserves. In 2015, the city produced over a million tonnes of waste, none of which was dealt with by collection stations or dismantling or treatment facilities¹⁷. The unregulated dumping of waste can have a dramatic effect on the health of households in the city. This was witnessed in 2006, when over 100,000 people had to be treated for illness and at least 15 people died following a major dump of waste across the city¹⁸. Cases such as this highlight the urgent need for action in Abidjan, as the long-term impacts of current practices could be devastating for the health of the population and their surrounding environment.

SOLUTION:

Coliba is a waste management company that offers off-grid recycling and recovery of plastic waste and transforms it for productive use. The solution consists of regular plastic waste collection by trained and equipped waste pickers employed by Coliba, who transport it to a sorting centre where it is recycled into pellets that can be used in local and international plastic-based industries. The solution also leverages mobile technology with a web, mobile and SMS platform that allows customers to connect with the waste pickers to schedule the collection of plastic, and accumulate points for MTN data or other supported products. In this way, customers are incentivised to recycle.

Coliba provides a formal solution to the plastic waste challenge, promoting sustainable development and creating jobs in the process. As of June 2019, Coliba had more than 4,500 active monthly users recycling up to two tonnes of plastic every day, with a total of 300 tonnes of waste recycled since it launched in 2017. According to One Young World, Coliba is operating 40 recycling centres in Ghana and 16 in Côte d'Ivoire¹⁹.

LOOKING AHEAD:

In March of this year Coliba, received an investment from GreenTec Capital Partners, a German investment company. Coliba will use these new funds to develop its plastic waste collection and processing business in Côte d'Ivoire. In collaboration with Voltic Mineral Water, Coliba is planning to build an additional 160 recycling centres in the coming years, expanding their contribution to the circular economy. By 2025, Coliba aims to reach more than two million users.

¹⁶ UNICEF (2019), A Future for Every Child by Beating Plastic Pollution.

¹⁷ Global Recycling (2018), Ivory Coast: Waste Management is Still a Problem Child.

¹⁸ Amnesty International (2018), A Toxic Legacy: The Case for a Medical Study of the Long-Term Health Impacts of the Trafigura Toxic Waste Dumping.

¹⁹ One Young World (2019), Coliba

CONCLUSION

Cities are growing rapidly across Sub-Saharan Africa, but contrary to past urbanisation trajectories in other regions, the expansion of cities is rarely accompanied by structural transformation. As a result of the lack of manufacturing and other job opportunities, a lot of urban growth is absorbed by informal settlements, where the majority of the urban population in Sub-Saharan Africa lives. As a consequence, many municipalities and city authorities are struggling to provide access to affordable and reliable basic services – a key prerequisite to ensuring greater social mobility. The emergence of COVID-19 has exacerbated these challenges, hindering daily economic activities of individuals working in the expansive informal sector and increasing the health risk for urban dwellers, who often lack critical basic services such as water or sanitation.

Making cities work for the urban poor, and ensuring that rapid urbanisation results in wealth creation and economic development, will be the most important challenge facing developing countries in the coming decades. With two-thirds of urban infrastructure investments from now until 2050 yet to be realised, there is tremendous scope to shape the trajectory of urbanisation, particularly in secondary cities, many of which will be transforming into booming urban agglomerations in the coming years.

The rise of mobile connectivity has not only introduced new data sources for evidence-based policymaking, which can reach marginalised communities such as the urban poor, but has also enabled the proliferation of market-creating innovations that make products and services more accessible to the urban poor.

Of course, no progress can be made without government and an appropriate amount of public funding, particularly with utility service provision. African governments (at both the city and federal level) will have to significantly increase

investments to ensure that cities become more inclusive and sustainable. Without public sector commitment and political leadership, such transformative change is simply unimaginable.

Given the vast sums that must be mobilised in the context of rapid population growth, climate change and economic inequality, African states and municipalities that are struggling to increase their tax bases and mobilise domestic resources will not be able to meet the challenge alone. It will be key for innovators throughout the developing world, underpinned by private investment and donors, to complement public sector activities and

collaborate with city authorities and governments to address the challenges facing the urban poor.

Here, mobile technology can be a key enabler of multi-stakeholder coordination across service delivery value chains, which provides transparency and accountability. It is critical to think about maximising the development impact of digitisation and technology. While the tech and donor

community rightly emphasise the massive opportunity for developing countries to leapfrog and learn from the mistakes of other countries' development trajectories, there are fundamental services that cannot be leapfrogged. Access to safely managed water and sanitation, reliable power supply, and proper waste management, are critical for economic development and social equality.

The challenge for cities and innovators is to direct the transformative power of mobile-enabled digital solutions towards urban development challenges, which will reap immense social returns. The GSMA Mobile for Development Utilities programme is committed to supporting innovative partnerships between municipalities, innovators and mobile operators, while also helping to scale innovative digital solutions for the urban poor.

Mobile technology can be a key enabler of multi-stakeholder coordination across service delivery value chains, which provides transparency and accountability

Editor-in-Chief: Nicolas Renard, Executive Director, Veolia Institute

Deputy Editor-in-Chief: Lorraine de Jerphanion, Program manager, Veolia Institute

Publication Director: Dinah Louda, President, Veolia Institute

Issuing Body:

Field Actions Science Reports (FACTS) is published by the Veolia Institute. EISSN: 1867-8521

Contact:

institut.ve@veolia.com

©AUTHOR(S):

Authors keep their copyright but allow people to copy, distribute, transmit and adapt their work provided they are properly cited.

Designed and produced by: **increa ***

Cover: Veolia Graphic Studio

Printed in France

with vegetable-based inks by an environmental printer (a member of Imprim'vert) on chlorine-free paper from well-managed forests and other controlled sources, certified in accordance with the standards of the Forest Stewardship Council.

Photo credits:

Veolia Picture Library, Adobe Stock, GettyImages, Istock and other credits as noted in the figure legends.

"We need to imagine what a 21st century African city, town and village should look like. Reimagined smart ecologically sound human settlements need to provide platforms for innovative sustainable essential public services."

Mamphela Ramphele

Co-founder of the ReimagineSA initiative, Co-President of the Club of Rome
Member of the Veolia Institute Foresight Committee

Veolia Institute

30, rue Madeleine Vionnet • 93300 Aubervilliers, France

www.institut.veolia.org