Digital Solutions for the Urban Poor

SCALING
OFF-GRID
ENERGY:
A GRAND CHALLENGE
FOR DEVELOPMENT

USAID
FROM THE AMERICAN PEOPLE

Mobile for Development Utilities

UKaid
from the British people

Foreword

The 30 fastest growing cities in the world are all located in Africa and Asia. Over the next 30 years, many of today's secondary cities and towns across the two continents will transform into metropoles. While this large-scale process will open up new opportunities for many, it will also pose profound challenges to governments, societies, the private sector, and individual citizens. Indeed, rapid urbanisation across emerging markets takes place in the context of sprawling informal settlements, a lack of social mobility, and deep inequalities in access to basic services. Unless innovative pathways emerge, water shortages, unsanitary conditions, unreliable power provision, and insufficient waste management will remain a defining reality for many, and in particular for the urban poor.

Digital technology will play a critical role in fueling innovation responsive to the needs of the urban poor. In fact, this is already in motion. "Pay-as-you-go (PAYG)" models for instance, which allow low-income customers to make small incremental payments towards otherwise unaffordable goods, and which have demonstrated great results when applied to rural electrification, are now also unlocking a range of urban services such as water, clean cooking gas, and sanitation.

Our GSMA Mobile for Development (M4D) Utilities programme provided catalytic early support to the pay-as-you-go solar sector, amongst other applications of digital technology that have the capacity to transform urban utility service provision. Since 2013, the programme's Innovation Fund has provided 50 organisations with over £9.4 million in grant funding, benefitting 2.8 million citizens directly through the grants' activities and a further 27.5 million through the growth of these organisations. Collectively, they have also raised close to £300 million in follow-on funding since receiving support from the Fund. Learnings from these projects along with other GSMA initiatives form the base of this report exploring sustainable solutions to crucial challenges facing the urban poor.

We are encouraged to see many key stakeholders in rapidly-urbanising economies recognise that while urbanisation poses a range of complex challenges, it also represents immense opportunity if managed properly. We firmly believe that by leveraging digital technology and partnering with the mobile industry, cities and innovators can unlock innovative business models that have the capacity to make basic services more affordable and more reliable for the urban poor. We are committed to continue to provide support to the transformative digital innovations that will help make cities work for everyone.

Max Cuvellier
Head of Mobile for Development

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Executive Summary

Two-thirds of the world's population will live in cities by 2050, with most urban growth concentrated in Africa and Asia. Although urban areas are generally associated with higher incomes and social mobility, rapid urbanisation in developing countries is generally not correlated with economic growth. Instead, it is associated with the rise of informal settlements, where over 60 per cent of urban dwellers in least developed countries are estimated to live.

This poses challenges to basic service provision as city authorities and utilities struggle to meet the demands of rapidly growing urban populations.

- In the Democratic Republic of Congo (DRC), 96.2 per cent of people in the highest urban income quintile (top 20 per cent) have access to at least basic water services, compared to just 37.2 per cent in the lowest quintile.[1]

- In Dhaka, Bangladesh, less than one per cent of sewage is treated effectively.[2]

- In cities throughout Nigeria, at least 22 million small gasoline generators are being used to power households and small businesses on a daily basis.[3]

- In Abidjan, Côte d'Ivoire, over 288 tonnes of plastic waste are produced per day, less than five per cent of which is recycled.[4]

- In Dar Es Salaam, Tanzania, the cost of a round-trip commute in an informal minibus is equivalent to 53 per cent of an average household's total daily expenditures.[5]

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.

Mobile-enabled digital solutions are uniquely placed to address these challenges. The expansion of mobile connectivity and mobile-enabled innovations in developing countries has enabled the proliferation of digital solutions that can make vital basic services, such as energy, water, sanitation, waste management and transport, more accessible and affordable. The spread of mobile money throughout Sub-Saharan Africa, and increasingly in Asia, is enabling innovative business models like pay-as-you-go (PAYG) to make otherwise unattainable goods and services accessible to low-income populations.

Technological innovations like smart metering, PAYG, big data, GIS and the Internet of Things (IoT) can be applied to many use cases, such as smart grids, solar home systems, mapping sanitation facilities, monitoring decentralised water points, mitigating peak traffic flow or managing waste flows.

Start-ups such as CityTaps, which provides prepaid smart metering services to urban water utilities, and Drinkwell, which operates water ATMs in informal settlements in partnership with water utilities, have shown there is tremendous potential to leverage innovative technologies and partnerships with mobile operators to make public utilities more efficient and responsive to the urban poor.

Meanwhile, PAYG off-grid energy providers, such as solar home system (SHS) provider Lumos, and the clean cooking gas company KOPAGAS, have shown that mobile-enabled innovations can unlock new markets by making goods and services accessible to low-income communities.

Mobile-enabled solutions have also empowered municipalities to better understand the challenges they face. In Kampala, Uganda, the Kampala Capital City Authority (KCCA) has used GIS technology to map sanitation facilities across the city's informal settlements and to coordinate pit-emptying services with entrepreneurs using a mobile app. In São Paulo, Telefónica Brasil has enabled municipalities to combat the adverse effects of pollution by harnessing its mobile network and using algorithms to collect, monitor, analyse and predict data patterns in combination with information gathered from weather, traffic and pollution sensors.

The GSMA Mobile for Development (M4D) Utilities programme, and the GSMA as a whole, are committed to leveraging the vast potential of mobile technology to make cities work for everyone. Through its next round of Innovation Fund[6] grants, the M4D Utilities team seeks to support even more mobile-enabled innovations to provide affordable and reliable basic services to the urban poor.

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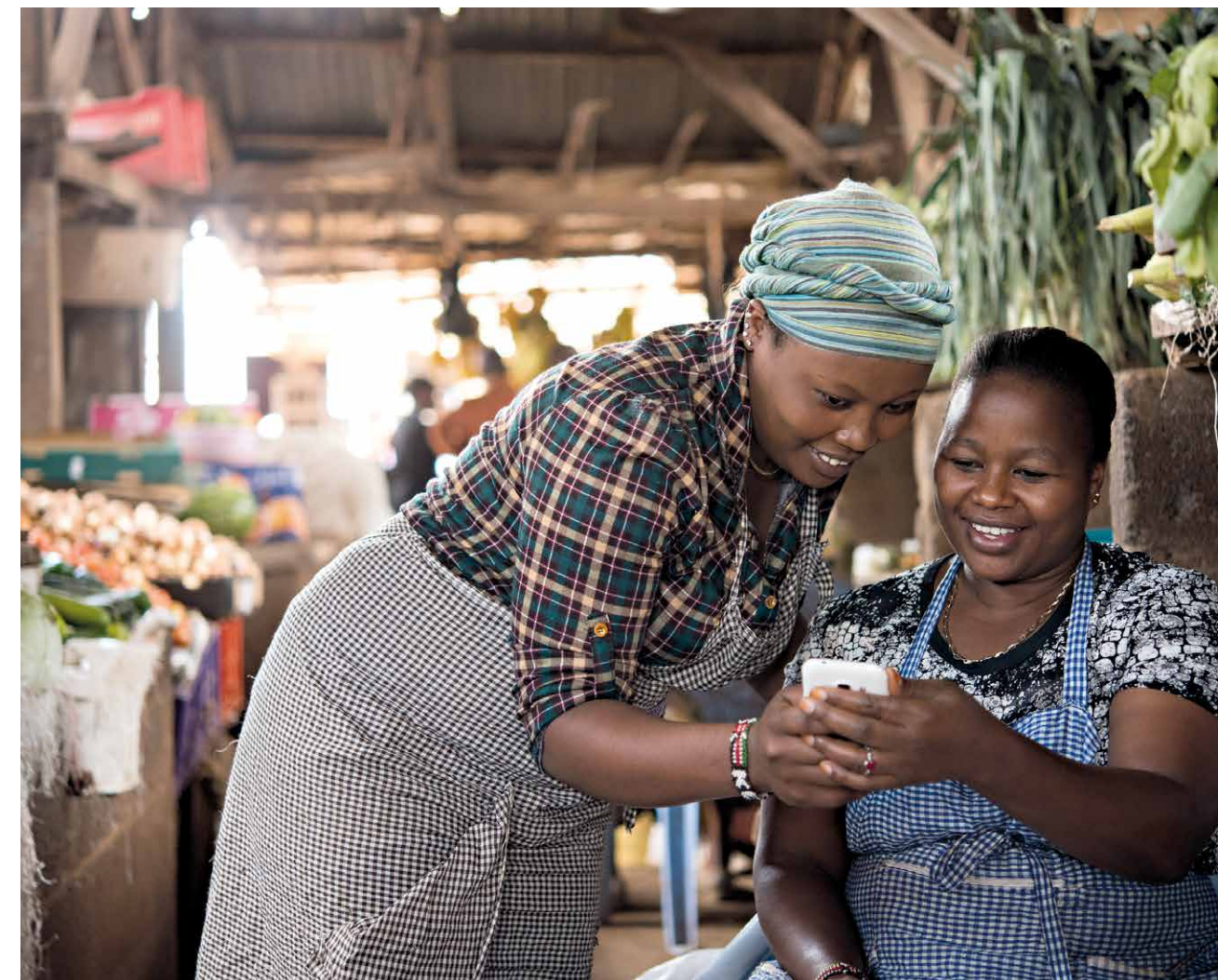
1. Unicef and WHO (2019), *Joint Monitoring Programme*.
2. Mansour (2017), *Situation analysis of the urban sanitation sector in Bangladesh*.
3. Access to Energy Institute and Dalberg (2019), *Putting an End to Nigeria's Generator Crisis: The Path Forward*.
4. UNICEF (2019), *A Future for Every Child by Beating Plastic Pollution*.
5. World Bank (2016), *Africa's Cities Opening Doors to the World*.

6. Mobile for Development Utilities Innovation Fund: https://www.gsma.com/mobilefordevelopment/m4dutilities/innovation-fund-2/

M4D UTILITIES PROGRAMME IMPACT 2012 - 2019

£ 9.4 million awarded through

☆ **53** grants

🔋 33 **Energy**   💧 14 **Water**   🚽 6 **Sanitation**

£ 286.3 million

raised by our grantees in investment from the private sector following our Innovation Fund contribution

🔋 £ 264.3 million

💧 £ 19.0 million

🚽 £ 3 million

Funded projects in

📝 **28** countries

direct partnerships with

📡 **42** mobile operators

2 Latin American countries

16 African countries

9 Asian countries

1 Pacific Island countries

Beneficiaries directly impacted through grants:

2,800,000+

Beneficiaries impacted in the years following the grant through scaling:

27,550,550+*

🔋

💧

🚽

We estimate that approximately 50 per cent of these are female.

* This includes a period of two years following the completion of the grant. A larger portion of these are attributed to the growth of Wonderkid, who serves 22 large utilities across Africa as of January 2019.
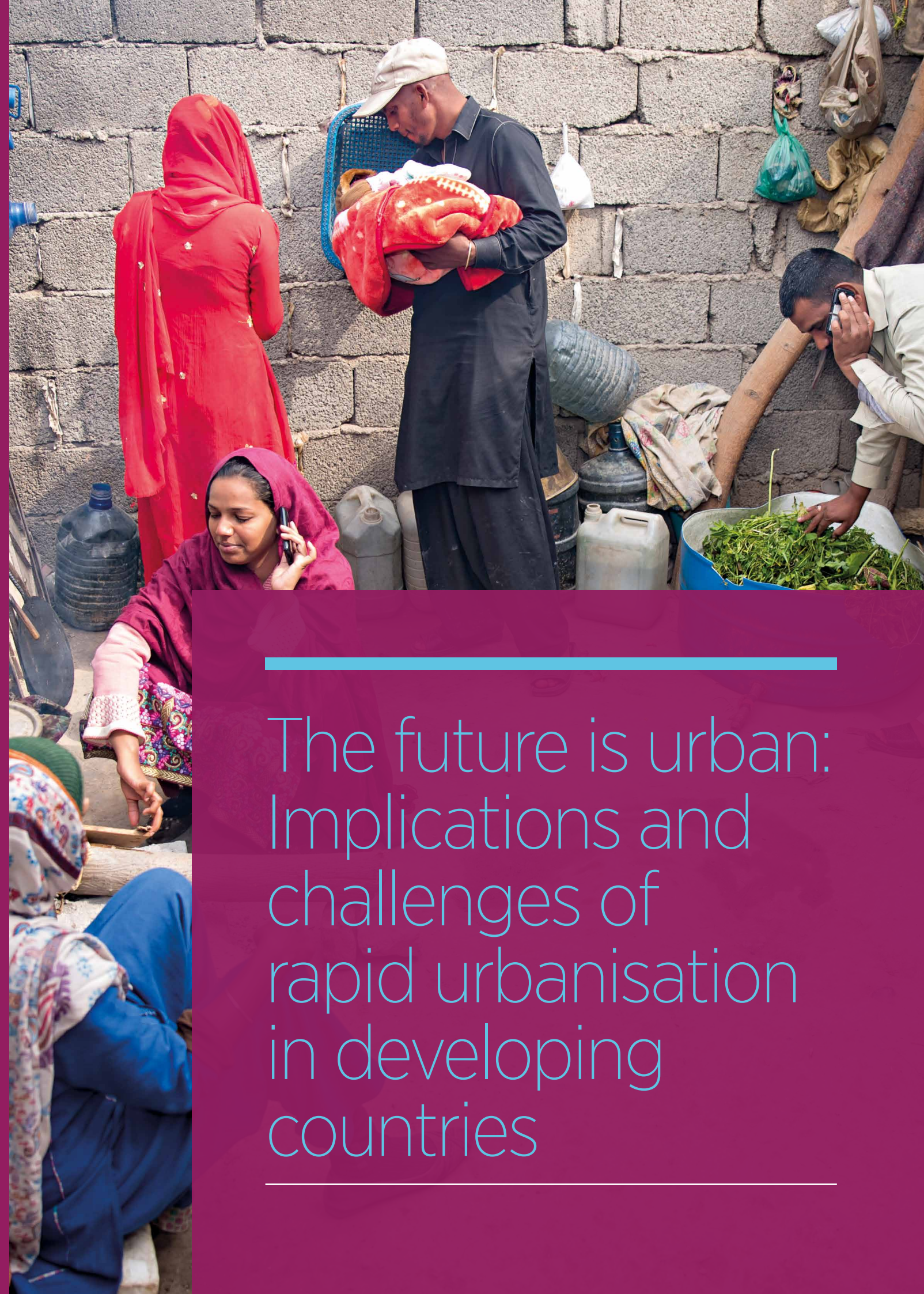
The future is urban: Implications and challenges of rapid urbanisation in developing countries

THE 30 FASTEST GROWING CITIES WITH A POPULATION OF OVER 1 MILLION ARE LOCATED IN AFRICA AND ASIA*

Nouakchott
Bamako
Niamey
N'Djamena
Aleppo
Ouagadougou
Onitsha
Abuja
Addis Ababa
Accra
Yaoundé
Mogadishu
Port Harcourt
Uyo
Kisangani
Kampala
Nairobi
Kinshasa
Mombasa
Kananga
Mwanza
Dar es Salaam
Luanda
Mbuyi-Mayi
Lusaka
Lilongwe
Antananarivo
Malappuram
Kozhikode
Kollam
Can Tho
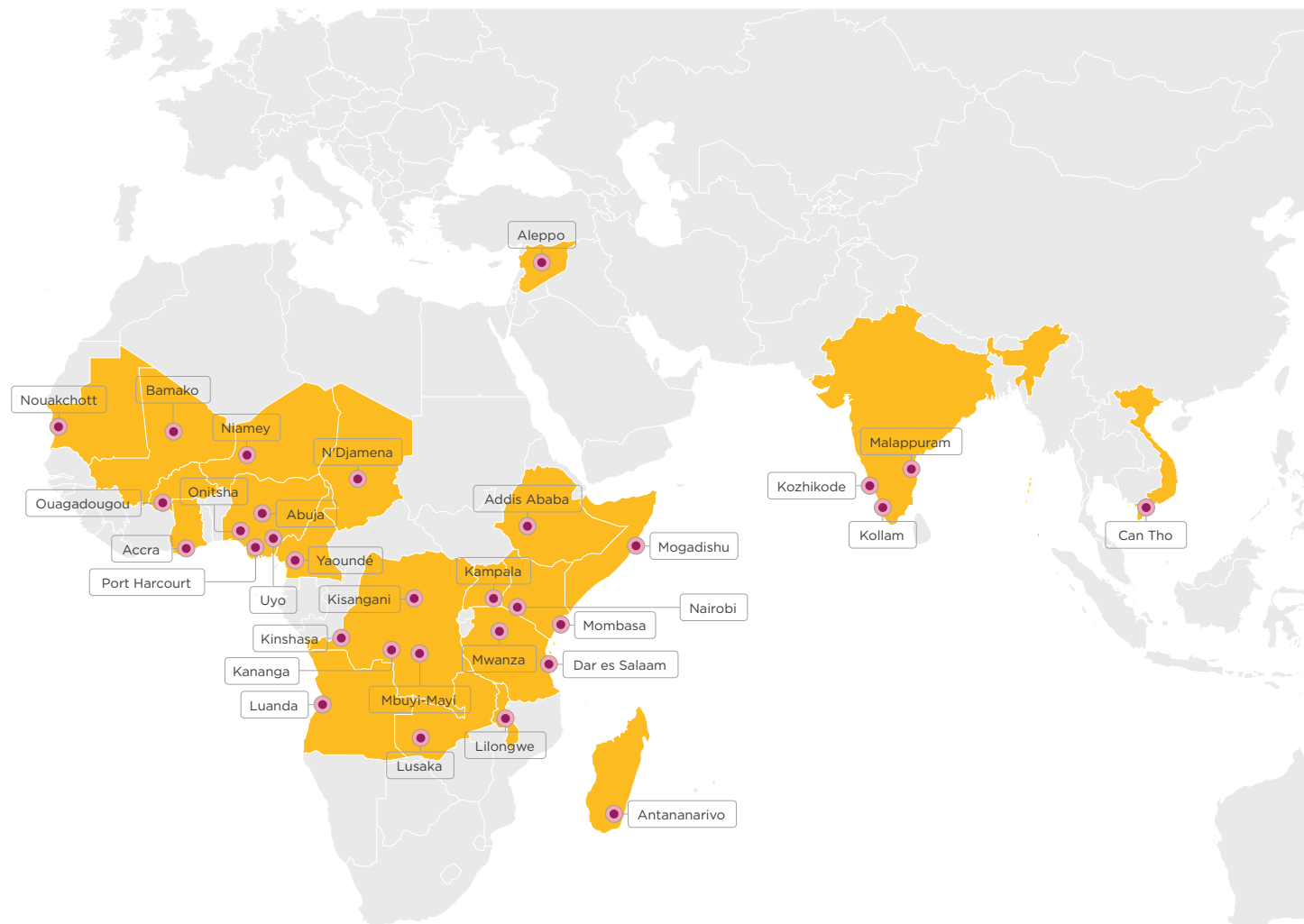
*Based on UN World Urbanisation Prospects database on fastest growing cities with a population of over 1 million

Africa and Asia are urbanising at an unprecedented pace and will account for 90 per cent of the world's urban population growth from now until 2050. Africapolis, a geospatial database of cities and urbanisation dynamics in Africa developed by the OECD, projects that cities in Africa, including newly formed secondary cities, will be home to another billion people by 2050. In Asia, the McKinsey Global Institute predicts that India's major cities (those with a current population of more than one million) will almost double by 2030. Latin America, where 81 per cent of the population already lives in cities (compared to 50 per cent in Asia and 43 per cent in Africa),[7] is the world's most urbanised region, home to over 55 cities with a population of one million or more.[8]

Yet, in many developing countries, particularly in Africa and Asia, urbanisation is accompanied by a profound paradox. Although urbanisation represents an immense opportunity — moving to a city is generally associated with higher standards of living, greater access to public goods and higher social mobility — the pace and intensity of urbanisation in many developing countries is posing profound challenges to cities and their growing informal settlements. According to the World Bank, over 63 per cent of the urban population in least-developed countries live in slums.

While economic theory suggests that increased urbanisation is generally associated with a "push" from rising agricultural productivity or a "pull" from industrial growth, rapid urbanisation in many low-income and lower-middle income countries is generally not accompanied by economic growth and structural transformation. Instead, it is often referred to as "urbanisation without structural transformation" or "urbanisation without growth". As Figure 1 shows, there is a clear correlation between growth and urbanisation in East Asia, but in Sub-Saharan Africa, this trend is less clear.

Figure 1   Source: World Bank (2019), Which Way to Liveable and Productive Cities?: A Road Map for Sub-Saharan Africa

Are growth and urbanisation correlated? Varying trajectories from East Asia and Sub-Saharan Africa between 1990 and 2016

A. EAST ASIA

Malaysia
Indonesia
Thailand
China
Vietnam

B. SUB-SAHARAN AFRICA

Liberia
Cameroon
Ghana
Guinea-Bissau
Madagascar
Zimbabwe
Nigeria
Kenya
Ethiopia
Rwanda
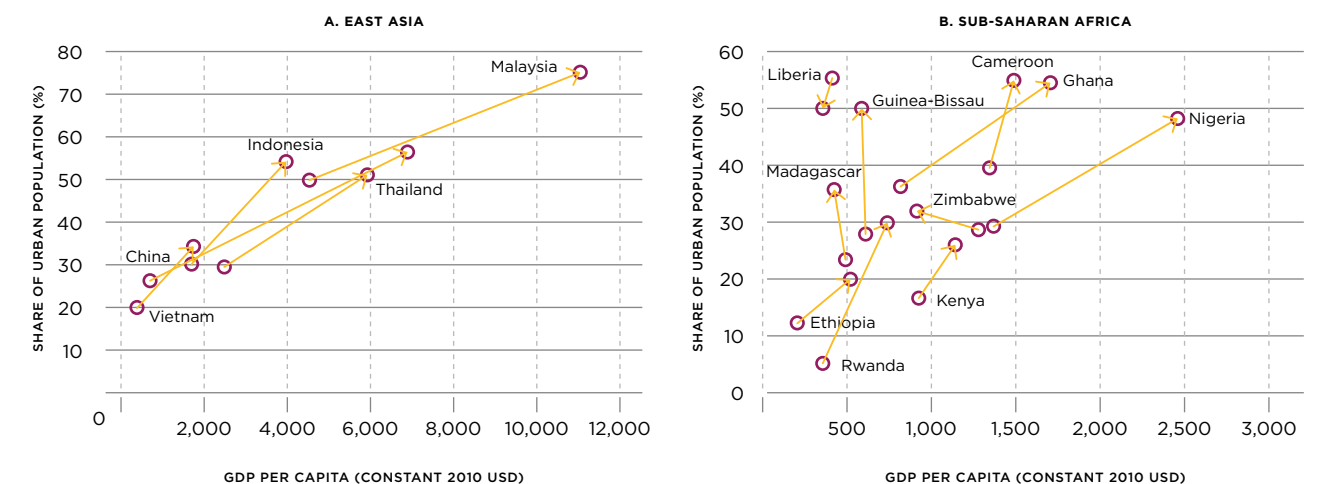
7.   UN DESA (2018), 2018 Revision of World Urbanization Prospects.
8.   BBVA Research (2017), Urbanization in Latin America.

Whereas urbanisation in the West or in East Asian countries, such as Singapore, Taiwan and China's coastal cities, has been synonymous with rising GDP per capita (see Figure 1), in many African countries, such as Liberia, Madagascar or Zimbabwe, there appears to be no correlation between urbanisation and structural transformation.

Experts warn that instead of benefiting from pathways to greater prosperity, many urban poor risk being locked into "poverty traps" given that they often settle in areas deprived of public and private investment. Such vast inequalities of opportunity not only hurt the urban poor, but also stifle economic growth and human capital development.

Urbanisation without growth has important implications for a city's built environment and its long-term ability to provide basic services to its population. Since the urban poor cannot afford to live in dense, well-connected neighborhoods, 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 (see Figure 2). 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. While less than 20 per cent of cities in developing countries are considered to be creditworthy enough to issue bonds to local investors, and only four per cent can access international capital markets, a substantial proportion of the over $2.5 trillion in investment estimated to be required to meet the Sustainable Development Goals (SDGs) will have to be invested in these very cities.[9]

- In Dhaka, Bangladesh, less than one per cent of sewage is treated effectively;[11]

- In cities throughout Nigeria, at least 22 million small gasoline generators are being used to power households and small businesses on a daily basis;[12]

- In Abidjan, Côte d'Ivoire, over 288 tonnes of plastic waste are produced per day, less than five per cent of which is recycled;[13] and

- In Dar Es Salaam, Tanzania, a round-trip commute in an informal minibus costs 53 per cent of the average household's total daily expenditures.[14]

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 prioritise the challenges of the urban poor and ensure that cities work for all.

Figure 2

Source: World Bank (2015), *City Creditworthiness Initiative: A Partnership to Deliver Municipal Finance.*

Creditworthiness of the 500 largest cities in developing countries

20% | CREDITWORTHY

80% | NON-CREDITWORTHY

Figure 3

Challenges facing slum dwellers
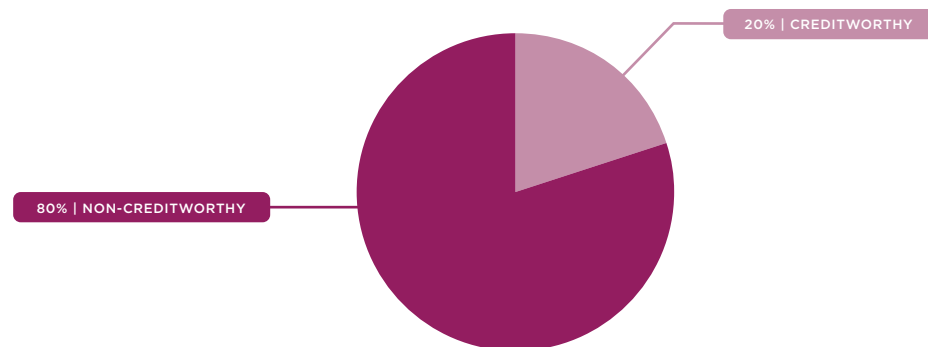
The financing challenge is often compounded by precarious property rights, regulatory ambiguity and sprawling low-rise informal housing that define many informal urban settlements. The capital expenditure required to provide basic infrastructure, such as water pipes or sewer networks, is "acutely sensitive to the density at which urbanisation occurs." 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 the DRC, 96.2 per cent of people in the highest urban income quintile (top 20 per cent) have access to at least basic water services, compared to just 37.2 per cent in the lowest quintile;[10]

9. UNCTAD (2019), *Promoting Investment for Sustainable Development in Cities.*
10. JMP (2019).

11. Mansour (2017), *Situation Analysis of the Urban Sanitation Sector in Bangladesh.*
12. Access to Energy Institute and Dalberg (2019), *Putting an End to Nigeria's Generator Crisis: The Path Forward.*
13. UNICEF (2019), *A Future for Every Child by Beating Plastic Pollution.*
14. World Bank (2016), *Africa's Cities Opening Doors to the World.*

How digital solutions can improve urban service delivery

The expansion of mobile connectivity throughout the developing world has enabled an emergence of digital solutions that are making vital basic services such as energy, water, sanitation, waste management, and transport, more accessible and more affordable. In Sub-Saharan Africa and Asia Pacific alone, the total number of unique mobile connections exceed 456 million[15] and 2.8 billion,[16] respectively. An additional 500 million subscribers are projected in these regions by 2025.

The spread of mobile money throughout Sub-Saharan Africa, and increasingly in Asia, has been a key enabler of digital payments and financial inclusion. As of 2018, there were more than 298.7 million active mobile money accounts in 90 countries making transactions worth $1.3 billion transacted every day.[17] Mobile money has been vital to digital innovations across Africa and Asia and allowed many organisations, start-ups in particular, to develop solutions tailored to the realities of consumers living in these parts of the world.

These innovations are exemplified by the rise of pay-as-you-go (PAYG) business models, which have facilitated access to basic energy services for millions of low-income consumers, and are now being replicated in other sectors. PAYG models leverage the ubiquity of mobile money in emerging markets to make goods and services more affordable to low-income communities. They represent a key opportunity in urban areas, which have a higher density of mobile money agents than rural areas. This higher density also means that urban mobile money agents have an incentive to provide better service, as they must differentiate themselves by liquidity level, reliability and other factors.[18]

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.[19] The rise of digital literacy is apparent in cities like Jakarta, Indonesia, where small informal shop owners are increasingly well versed in the digital payment and logistical opportunities offered by "super apps".[20] Shop owners are finding creative ways to market their products on super apps to large consumer segments and access credit to expand their operations.

Digital solutions, such as PAYG, GIS tracking, smart metering, big data analytics or mobile-enabled Internet of Things (IoT) devices, offer unique opportunities to tackle complex challenges that not only require tailored, cost-effective solutions, but are also capable of coordinating a range of public, private and civic stakeholders.

These solutions optimise basic service provision by facilitating supply and demand, particularly in the informal economy where the urban poor conduct most of their consumption and production activities. Lack of information and access to services are significant barriers to both informal sector workers and consumers. Yet, the rise of mobile platforms that connect consumers and suppliers, while also offering vital value-added services, can be critical. They not only enable informal sector workers to access 'ladders to formality' (see Figure 4), they also make urban services more affordable and reliable.[21]

15.   GSMA (2019), *The Mobile Economy Sub-Saharan Africa 2019.*
16.   GSMA (2019), *The Mobile Economy Asia Pacific 2019.*
17.   GSMA (2019), *State of the Industry Report on Mobile Money.*
18.   Boston Consulting Group (2019), *How Mobile Money Agents Can Expand Financial Inclusion.*
19.   GSMA (2019), *State Of Mobile Internet Connectivity Report.*
20.   Financial Times (2019), *Fintech: the rise of the Asian 'super app'.*
21.   Center for Global Development (2018), *Let's Be Real: The Informal Sector and the Gig Economy are the Future, and the Present, of Work in Africa.*

Figure 4   Source: Center for Global Development (2018), *Let's Be Real: The Informal Sector and the Gig Economy are the Future, and the Present, of Work in Africa.*

Ladders to formality
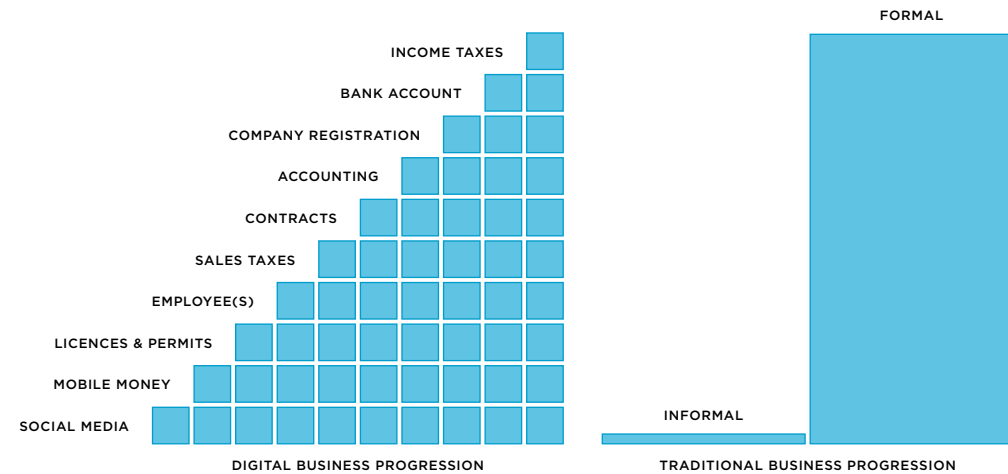
The rise of businesses leveraging mobile platforms has already disrupted paratransit (i.e. partially self-organised, market-driven minibus systems moving millions in and between cities daily) in African and Asian cities. In the ride-hailing and ride-sharing sector, digital platforms have the potential to formalise employment, improve working conditions, rationalise transport routes and reduce corruption. This is exemplified by Grab in Singapore and Go-Jek in Indonesia, two mobile apps that have scaled in multiple markets in Southeast Asia. Initially launched as ride-hailing solutions, the companies have breached the fintech sector by allowing users to make cashless transactions, order delivery services and book a ride on the app. Super apps like these, which leverage distribution networks and the dynamism of the informal sector to offer value-added services, have mushroomed across Africa and Asia. In the transport and logistics sector, they enable otherwise unaccountable drivers to adhere to certain safety and security standards while also offering them a range of benefits, such as insurance and training.

Go-Jek and Grab are valued at close to or over $10 billion respectively,[22] and have provided new opportunities for millions of small merchants across Southeast Asia. Although ride-hailing markets in Africa are still quite small in comparison, ride-hailing and ride-

sharing solutions attracted a substantial proportion (40.6 per cent) of the $128.4 million invested in African transport and logistics companies in 2019 (in rounds totaling a million dollars or more).[23]

Mobile platforms and other digital solutions can be critical in supporting informal entrepreneurs to build growing businesses, while also delivering more reliable and more affordable basic services. Since many cities struggle to provide vital basic services such as recycling, faecal sludge management, or the provision of safe drinking water, many informal sector entrepreneurs have tried to fill the gap. As the informal sector is the main employer of the urban poor across Africa and Asia, there is tremendous scope for mobile-enabled platform models in other sectors, too. They are particularly relevant in the sanitation and waste management sectors where digital solutions, as well as partnerships with municipalities, can enable entrepreneurs to derive more value from the circular economy value chain. The GSMA's recently launched Clean Tech programme has already found promising use cases when it comes to plastics recycling. For instance, South Africa-based Packa-Ching allows members of low-income communities to bring their bags of recyclable packaging material in exchange for digital payments into a cashless e-wallet payment system called eVoucher.Mobi.

22.   Tech Crunch (2019), *No, Go-Jek isn't valued at $10 billion… yet*
23.   Baobab Insights (2019).

Advances in innovative digital technologies, such as the IoT or big data, provide cities with an opportunity to become more resilient to shocks and manage their challenges more efficiently, while also creating new revenue-generating opportunities. By harnessing connectivity, a city can improve services and lower costs across a range of areas, from waste collection and faecal sludge management to mobility and transport. New digital data sources (including GIS and geotagging, sensors, Wi-Fi hotspots and mobile apps) are becoming increasingly relevant to cities

in developing countries, while many traditional data sources face major limitations, such as the cost and complexity of capturing data, the challenge of interpreting static data in a dynamic world and the reluctance of individuals to provide personal information to external sources.[24]

This report identifies five technological innovations that have helped entrepreneurs in different sectors to scale and reduce operational expenses while also reaching low-income communities (Figure 5).

Figure 5

How mobile-enabled digital solutions are relevant in the urban context

SOLUTION	RELEVANCE	USE CASES
Pay-as-you-go	Make services affordable for poor consumers because they can make micropayments; more effective revenue collection in informal settlements for service providers	Business models for energy, water, sanitation, clean cooking appliances
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	Mapping sanitation facilities; geolocating potential customers; facilitating collection and transport
Smart metering	Automatic meter reading records consumption and key operational data	Smart meters for energy and water service providers
IoT/M2M connectivity	Smart monitoring of systems, which can increase operational efficiency	Water point monitoring; smart grids
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

Pay-as-you-go models: Making essential utility services affordable

Most governments and state-owned utilities in emerging markets are struggling to respond to the growing demands of rapidly expanding and profoundly unequal societies. This means that many low-income communities simply cannot rely on

governments to provide services and must instead opt for costly, inconvenient and unsafe alternatives. To address this challenge, several utilities have turned to mobile payment solutions to reduce operational losses and make payments more affordable, transparent and convenient. This, in turn, allows utilities to improve revenue collection and expand networks to low-income residents.

24.   World Economic Forum (2015), *What Mobile Phones Teach Us About Cities.*

At the same time, 'off-grid' innovators have looked beyond traditional utility models to more decentralised solutions to deliver services where networked infrastructure is not physically or economically feasible. Through regular small instalments made remotely via mobile money, these PAYG models open access to assets or services to low-income customers that are otherwise unattainable.

The rise of PAYG models has been made possible by the convergence of innovations around the IoT, cloud computing and mobile financial services, as well as GSM services like voice, SMS and data. These underpin the PAYG model in three main ways:

- They enable payment collection through mobile money or other forms of mobile payment;

- They update and control PAYG-enabled assets or services through machine-to-machine communication (M2M) or a keypad; and

- They enable communication between service providers, customers and local agents through mobile devices and services, such as SMS or mobile apps.

The PAYG model has been extremely successful in the off-grid energy space, which primarily serves rural, peri-urban and informal settlements not connected to the national grid. Two million solar home systems (SHSs) were sold on a PAYG basis in 2018 alone.[25] From 2012 to 2018, the PAYG solar market raised just over $961 million as several new entrants joined the sector in markets with large off-grid populations. In 2018, investment increased by 20 per cent to reach a record $352 million. Through the help of grant funding from programmes such as GSMA Mobile for Development Utilities, PAYG innovations are now spreading to other areas like water, energy-efficient domestic appliances, cooking gas and even smartphones.

For many off-grid energy providers, such as Zola Electric, which is active in five African markets, or M4D Utilities Innovation Fund grantee Lumos (see the case study in the section, *Tackling challenges with technology*), energy-poor urban/peri-urban communities are a key target segment. Similarly,

Nigeria-based energy provider Rensource, which builds and operates solar-powered microutilities that provide electricity to commercial community structures like open-air trading bazaars, has recently raised a $20 million Series A round and is looking to become the primary utility for large urban markets in Nigeria that are underserved by the national grid.

PAYG is proving particularly transformative for service providers because it allows them to leverage customer payment histories to qualify customers for add-on products, such as cook stoves, refrigerators, and even smartphones. M-Kopa, which has sold over 750,000 SHSs to a mainly rural customer base that is 80 per cent low income, offers certain customers a 100-litre solar fridge that could be key to increasing the productivity of small shop owners.[26] PAYG companies are also using customer payment histories to offer financial services, such as access to financing for school loans and insurance. In Uganda and Tanzania, SHS providers Fenix and M-KOPA are offering loans for school fees to their best-paying customers.[27]

Innovations in emerging markets succeed by targeting non-consumption and providing new and affordable ways for low-income consumers to purchase (and use) a product or service that was previously inaccessible.[28] Given that this not only applies to energy services, but also to other vital services and consumption goods, there is immense potential for the PAYG model to be replicated in other use cases. As the case studies of Innovation Fund grantees KOPAGAS, Drinkwell, and Citytaps highlight, this process is already well under way.

Mapping and defining physical boundaries: How GIS is facilitating connections and localisation

GIS, which enables portable handheld devices to measure physical and geographical boundaries, has become a groundbreaking tool in urban and rural areas where planning efforts have been hindered by lacking information and informality. For instance, high mobile penetration combined with GIS-equipped mobile phones are able to generate urban mobility data and provide information about the state of traffic in several African cities. South Africa-based WhereIsMyTransport

uses mobile GIS data to provide transport information for cities such as Johannesburg, Kampala and Dar es Salaam. Similarly, in informal settlements, GIS tools have become a useful way to geolocate households and community assets, and to optimise processes and supply chain management via real-time tracking (see the Kampala City Authority case study in *Tackling challenges with technology*).

This is exemplified in container-based sanitation (CBS), which refers to sanitation systems lacking sewage pipes where toilets collect human excreta in sealable, removable containers that are transported to treatment facilities. The scalability of CBS services hinges on their ability to optimise and coordinate different activities along the sanitation value chain while generating revenue from toilet resources through waste-to-fertiliser or waste-to-energy use cases. GIS tools can enable CBS providers to optimise agent logistics while reducing operational costs. Through the GSMA M4D Utilities Innovation Fund, the Container-Based Sanitation Alliance, which unites service providers from Ghana (Clean Team), Kenya (Sanivation and Sanergy), Haiti (SOIL), Madagascar (Loowatt) and Peru (X-Runner), received a grant to develop a mobile app and web-based platform to support agent logistics and customer management for household sanitation services in several countries. Other players, such as Ugandan data provider and geolocalisation company Geo Gecko, provides geo-intelligence products and services to service providers and municipalities in Uganda.

Smart meters make utility services more efficient and customer friendly

Smart meters linked to cloud-based software platforms keep users and service providers constantly informed about consumption patterns but, more importantly, provide utility service providers with an opportunity to create smarter grids to meet increasing demand.

Systems that can automatically detect and respond to issues like theft, malfunction or leakage, are crucial in a context where the supply of utility services is already struggling to meet rapidly growing demand. Enabling utility service providers to invest in smart meters, and tailoring smart meter deployments to local contexts, is therefore critical to improving cost recovery for utilities in emerging markets (see the CityTaps case study in *Tackling challenges with technology*).

Smart meters are a cornerstone of innovative utility service delivery in both on- and off-grid contexts. In the off-grid space, KOPAGAS has developed a PAYG cooking gas business in Dar es Salaam. The model relies on an IoT-enabled smart meter that enables customers to pay via mobile money and consume small amounts of gas at a time, while providing timely and granular usage and payment information. Sixty-two per cent of KOPAGAS customers reported they are better able to manage this household expenditure as a result of the smart meters. The technology has enabled KOPAGAS to scale liquefied petroleum gas (LPG) delivery throughout Dar es Salaam, thereby reducing the risk of airborne diseases from cooking with charcoal. Other off-grid use cases of smart sensors are decentralised water providers, such as water ATMs, or decentralised energy delivery models, such as mini-grids.

For on-grid applications, smart meters can help utilities centralise their monitoring of customer consumption patterns to manage peak demand and reduce losses, which in turn enhances communications with customers. For instance, in September 2015, Dialog Axiata (in partnership with LECO, Sri Lanka's state-owned power utility) received a grant from the GSMA M4D Utilities Innovation Fund to develop a smart metering and network monitoring solution to improve the capability of the electricity grid. Dialog, LECO and the government are enthusiastic about the service and 25,000 additional meters have been manufactured. LECO plans to deploy 100,000 over the next two years.

Hyperconnectivity and lower costs: The rise of the Internet of Things

The groundbreaking contribution of the Internet of Things (IoT), a system enabled by the presence of mobile- and internet-connected computing devices capable of sending, receiving and interpreting data, represents a switch from a fundamentally disconnected world to one where machines and people are in constant communication. The use cases for IoT cut across sectors and contexts, from transport to health and from developed to developing countries, and can range from measuring water pressure to making devices responsive to weather patterns. IoT-enabled innovations allow service providers to communicate updates in real time and intervene only when necessary, thereby reducing costs for themselves and their customers.

25.   GOGLA (2019), *Global Off-Grid Solar Market Report.*
26.   M-Kopa (2019), *Impact Report.*
27.   Wolfram, C. (2019), *Are We Looking for the Benefits of Rural Electrification in the Wrong Places?* Energy Institute Blog. See also: https://twitter.com/mkopasolar/status/1034008870581137408?lang=en
28.   Christensen, Dillon and Ojomo (2019), *The Prosperity Paradox: How Innovation Can Lift Nations Out of Poverty.*

Kenya-based start-up Upepo leverages IoT to provide intelligent water management solutions that support water utilities and water community associations. It also helps large abstractors of surface and groundwater, including agricultural enterprises, industries and commercial property owners, to accurately measure and manage water and predict future consumption trends.[29] Chennai-based WeGot Utility Solutions has developed a mobile-based IoT solution for water utilities, and is now developing a similar solution for energy use cases. Given that the region surrounding Chennai has suffered from water basin depletion and is struggling to maintain sufficient water supply in the context of rapid urbanisation, such solutions can be vital in responding to the challenge of urban water scarcity (see *Tackling challenges with technology*).

IoT solutions are set to become even more relevant in developing countries as smart devices such as smartphones become more affordable, and as mobile operators roll out Narrowband Internet of Things[30] (NB-IoT) networks in emerging markets like Kenya and Bangladesh.

Big data: Enabling analysis of trends, projections and more informed decision making

Big data refers to the field of statistics and analysis that processes large data sets generated by a variety of sources, from sensors to cloud, in different formats. Global problems like pollution, disease epidemics or environmental disasters require informed and strategic responses, and the ability to generate and access large volumes of network data through mobile connectivity and various mobile use cases provides unique opportunities for mobile network operators (MNOs), public sector stakeholders and entrepreneurs. Integrating mobile solutions and big data in city management activities is helping to inform appropriate and forward-looking responses to previously unpredictable and unmeasurable challenges. In developing countries, big data has come to be an effective tool in monitoring the spread of infectious diseases, informing residents and city authorities about real-time pollution levels, managing traffic or facilitating disaster preparedness.

Initiatives such as Digital Matatus[31] have leveraged the ubiquity of mobile data networks to build a digital transit map of matatus routes (privately owned mini vans that are the backbone of informal public transport in many developing countries), serving millions of commuters every day across Nairobi. A collaboration between Kenyan and American researchers and Nairobi's tech sector, the project captured transit data for Nairobi, developed mobile routing apps and designed a new transit map for the city. Several other new projects, such as Digital Transport for Africa, are trying to use a similar methodology in African cities. Applying advanced analytics to raw data has provided critical intelligence for emergency responses and supported long-term mitigation strategies for other critical challenges. Nairobi-based Flare offers emergency and fast response via mobile in the absence of sufficient first aid services. Big data has proven particularly relevant in the health sector, including impactful initiatives that use large data sets, such as Bloomberg's Data for Health[32] and a Gates Foundation-backed effort to map malaria outbreaks.[33]

Big data can be generated from interconnected devices (IoT) as well as other data channels, such as GSM usage. These large data sets open up a range of predictive and monitoring solutions from weather forecasting to traffic management and pollution control, and mobile penetration has dramatically expanded the ability to generate reliable and up-to-date information. In this sense, MNOs are uniquely positioned to leverage the abundance of data they produce to anonymously produce topographies and forecasts.

GSMA's Big Data for Social Good team has successfully piloted big data solutions in partnership with MNOs across a range of use cases, including healthcare, disaster response, disease prevention, air pollution management and financial inclusion. The programme has also provided thought leadership on issues such as mobile privacy and big data analytics, and AI ethics, which is critical to ensuring technological solutions protect the most vulnerable and are embraced by relevant stakeholders.

Tackling challenges with technology: How innovators are improving conditions for the urban poor

29.   Microsoft (2019), Upepo Technology recieves Microsoft AI for Earth grant
30.   Narrowband Internet of Things (NB-IoT) is a Low Power Wide Area Network (LPWAN) radio technology standard developed by 3GPP to enable a wide range of cellular devices and services
31.   MIT (2015), Digital Matatus project makes invisible visible.
32.   Bloomberg: https://www.bloomberg.org/program/public-health/data-health/#overview
33.   BBC (2019), Big data can stop malaria outbreaks before they start.

This chapter focuses on five key challenges facing the urban poor in developing countries: energy, water, sanitation, transport and waste management. It highlights how these challenges are manifested in different cities across different regions, including two in Asia, six in Africa and one in Latin America. Figure 6 depicts the population growth challenge across cities.

It then examines how mobile-enabled innovations supported by the GSMA M4D Utilities Innovation Fund, the GSMA Ecosystem Accelerator Innovation Fund and the GSMA Big Data for Social Good programme have helped start-ups, state-owned utilities and city authorities address these challenges.

Figure 6

Source: UN, *The World's Cities in 2018*.

Trends in urban population growth across developing countries

CITY POPULATION (IN MILLIONS)				
	TYPE	2000	2018	2030 (PROJECTED)
DHAKA	Metropolitan area	10.2m	19.6m	28.1m
SÃO PAULO	Metropolitan area	17.0m	21.7m	23.8m
LAGOS	Urban agglomeration	7.3m	13.5m	20.6m
DAR ES SALAAM	Urban agglomeration	2.2m	6.0m	10.8m
ABIDJAN	City proper	3.0m	4.9m	7.1m
KAMPALA	Urban agglomeration	1.2m	3.0m	5.5m
ANTANANARIVO	Urban agglomeration	1.4m	3.0m	5.1m
PESHAWAR	Urban agglomeration	1.1m	2.1m	2.9m
NIAMEY	City proper	0.7m	1.2m	2.0m

Unplugged: How rapid urbanisation is leaving many in the dark

According to the World Bank, over 600 million people are expected to still be without electricity in 2030, a large proportion of whom will live in Sub-Saharan Africa. Many of those who do have access to electricity still rely on kerosene and diesel generators, at least as back-up systems during power outages. Due to rapid urbanisation and the growth of informal settlements, which are often cut off from the national electricity grid, the urban poor are particularly affected by unreliable energy access. Since urban energy access levels in least developed countries (at 79 per cent)

significantly exceed energy access levels in rural areas (at 37 per cent),[34] many donors and policies aiming to achieve SDG 7 (access to affordable and clean energy for all) have been focused on extending electricity access to rural off-grid communities. However, due to rising energy demand in cities across all developing countries, some of this attention needs to be redirected to urban energy provision. Without plans for affordable and reliable urban energy provision, several countries not only risk failing to meet SDG 7, but also depress the economic potential of several emerging cities.

Figure 7

Source: Power Africa (2019)

Urban energy access rates in selected African countries
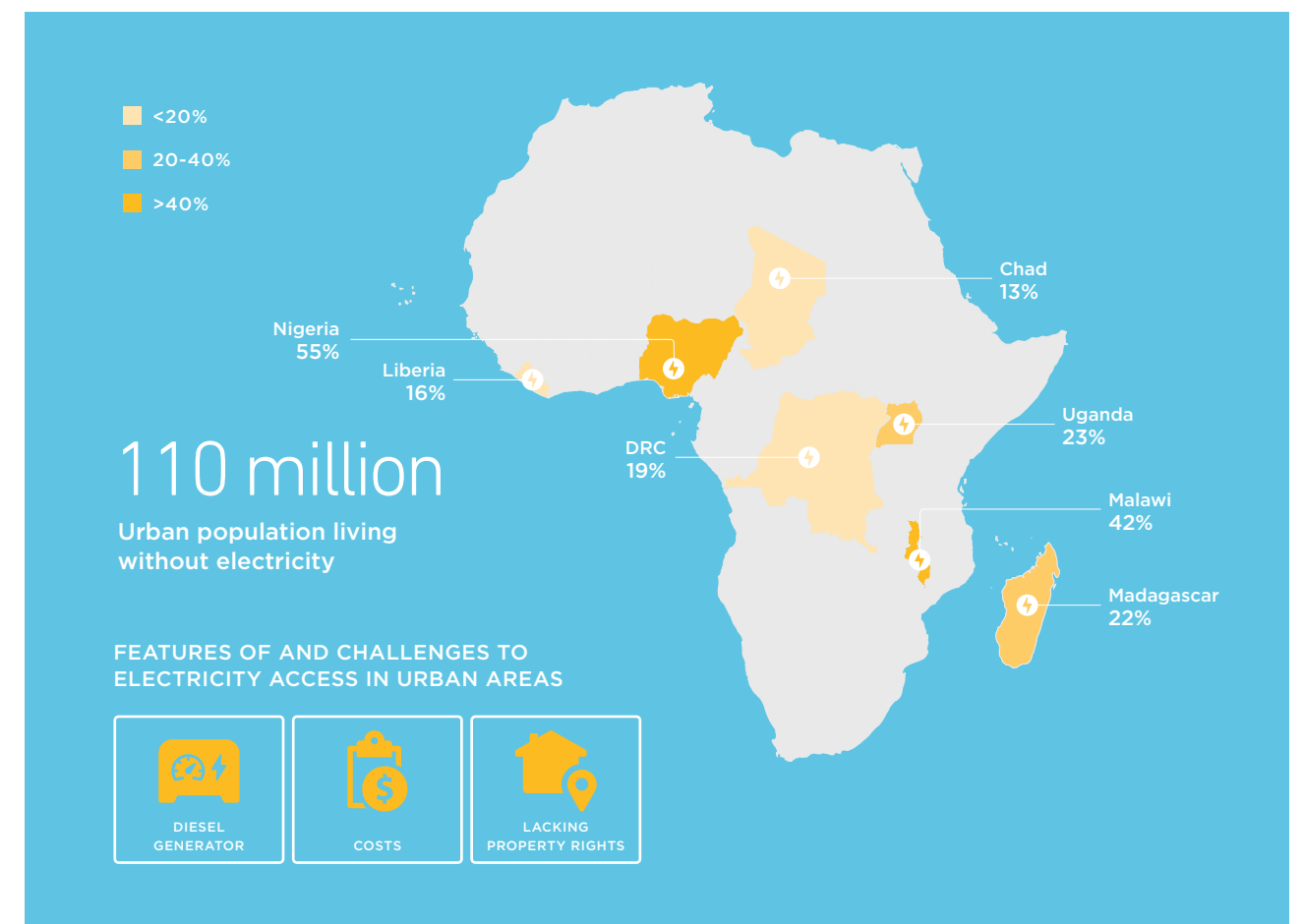
34. World Bank (2017), *World Bank Development Indicators*.

Cities are the engines of economic growth (accounting for 75 per cent of global GDP), but they are also responsible for the bulk of global energy demand. For cities in the developing world, this can have diverging socio-economic implications ranging from pollution to power shortages. For example, while energy access is nearly universal in cities across India, according to the WHO Global Urban Ambient Air Pollution Database, the country is home to 14 of the 20 most polluted cities in the world.

Meanwhile, 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 areas.[35] 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 grid (see Figure 8).[36] 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. This also affects emerging markets in Asia. The World Bank estimates that the cost of power outages and distortions in Bangladesh, India and Pakistan is equivalent to four to seven per cent of GDP every year.

In Nigeria, the country with the largest urban off-grid market globally, the situation has given rise to an unprecedented proliferation of small 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. Supported by government gasoline subsidies ranging from $1.6 to $2.2 billion per year, the combined electricity generation capacity of Nigeria's diesel generators is eight times greater than the grid's peak capacity.[37] Excessive expenditures for back-up electricity (such as diesel generators) prevent small business owners from investing in their businesses. On average, Nigerians spend about NGN 3,374 ($17) on their monthly electricity bills, according to data from NOIPolls. The monthly cost for the fuel to run generators is an additional NGN 9,529 ($48). This can add up to 30 per cent of average monthly household income.

Figure 8

Source: World Bank Enterprise Survey (2019)

Implications of power outages for businesses in Africa

Legend:
- SHARE (%) OF FIRMS OWNING A GENERATOR
- AVERAGE ANNUAL OUTAGE TIMES (IN DAYS)
- AVERAGE ANNUAL OUTAGE LOSS AS % OF ANNUAL SALES

190 DAYS

Countries: Ghana, Kenya, Mali, Mozambique, Nigeria, Senegal, South Africa, Zambia

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35. Shirley (2018), *Millions of urban Africans still don't have electricity: here's what can be done.*
36. Quartz Africa (2018), *The cost of electricity shortages in Africa is more than just a problem of access.*
37. Access to Energy Institute and Dalberg (2019), *Putting an End to Nigeria's Generator Crisis: The Path Forward.*

Meanwhile, 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 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. Clean fuels are scarce across low-income countries and at least 80 per cent of households globally cannot access cooking gas in small quantities.[38]

Dar es Salaam: The challenge of phasing out dirty cooking in informal settlements

With a current population of six million, Dar es Salaam is one of the fastest growing cities in the world and is set to be home to over 10 million people by 2030. City planning has become a near impossible task at the current rate of urbanisation, as more than 75 per cent of the city's population lives in informal settlements.[39] Insufficient commitment to and implementation of master plans for sustainable city development has led to substandard infrastructure, land degradation and a severe lack of public services in Dar es Salaam. The burden of inadequate planning falls largely on the city's poorest.[40]

One item on the government's new city planning agenda is upgrading informal settlements. This includes phasing out the use of charcoal and firewood, which

has long been the only affordable alternative to energy for the urban poor given the lack of access to reliable electricity. Studies suggest that the vast majority of households in Dar es Salaam use charcoal and firewood as their main sources of energy and cooking.[41]

As part of government efforts to reduce the production of charcoal in the country by 2025, service providers are being encouraged to offer cleaner sources of energy that are also affordable.[42] One such substitute is ethanol, and the United Nations Industrial Development Organization (UNIDO) has partnered with Project Gaia to roll out 500,000 ethanol cookstoves to households in Dar es Salaam.[43] Substituting charcoal for LPG when cooking is another alternative that can significantly reduce exposure to carbon monoxide.[44]
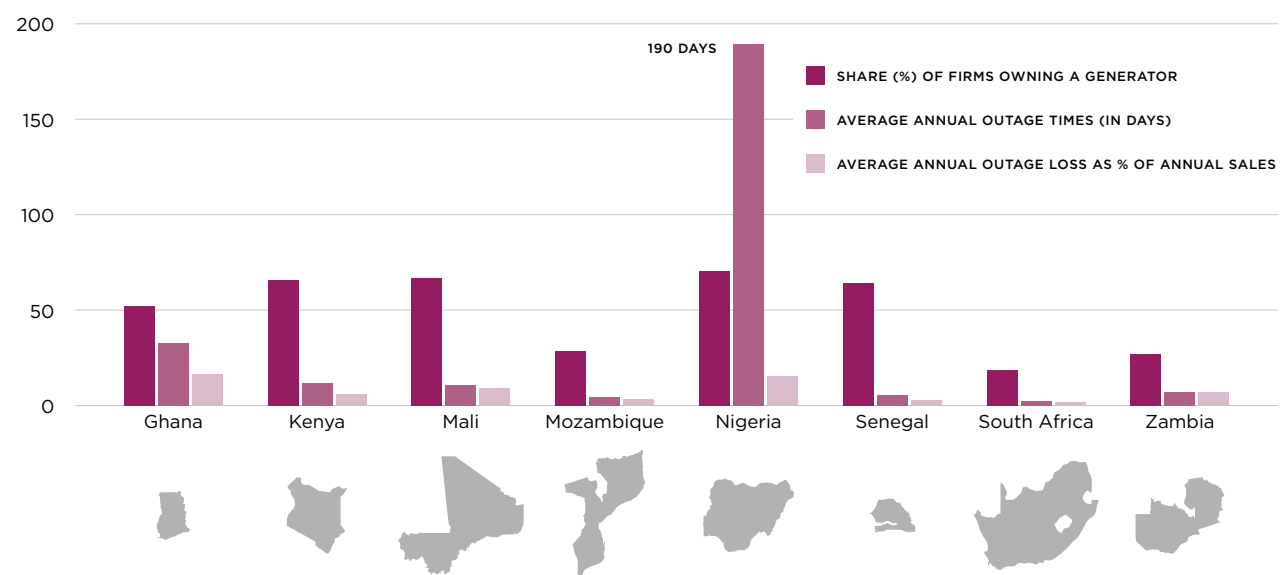
KOPAGAS: Providing access to innovative clean cooking solutions for the poor

KOPAGAS has developed pay-as-you-go clean cooking solutions for low-income families in developing countries. In collaboration with Oryx Tanzania, and in partnership with Vodacom and Airtel Tanzania, KOPAGAS offers a cost-effective meter and PAYG cooking gas service, allowing users to purchase only the amount of cooking gas they need daily through mobile money. The solution incorporates IoT and M2M technology 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.

32 per cent of KOPAGAS' 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, PAYG service has reached over 117,000 people in 3,500 households across Tanzania and will continue to play an important role in replacing the hazardous firewood and charcoal

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38. PayGo Energy: https://www.paygoenergy.co/
39. Rosen, J. (2019), *This Tanzanian City May Soon be One of the World's Most Populous. Is it Ready?*
40. Peter, L. and Yang, Y. (2019), *Urban Planning Historical Review of Master Plans and the Way Towards a Sustainable City: Dar es Salaam, Tanzania.*
41. Sembony, G. (2018), *Tanzania: For Less Charcoal Consumption, Use Energy Saving Stove.*
42. Namkwahe, J. (2019), *Tanzania Environment Minister Shows How to Cut Use of Charcoal.*
43. Thomas, J. (2019), *UNIDO Rolls out 500,000 Clean Cook Stoves in Dar es Salaam.*
44. Legonda et al. (2013), *Carbon Monoxide Exposure during Cooking in Households: A Case of Dar es Salaam City, Tanzania.*

typically used for cooking in many developing countries. 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 $60–100.[45] PAYG is making clean cooking via LPG attainable for Dar es Salaam's urban poor. 61 per cent of KOPAGAS customers said their monthly spending on fuel has "slightly" or "very much" decreased since connecting to KOPAGAS.

Looking ahead: In January 2020, Circle Gas Limited, acquired KOPAGAS in a transaction worth $25 million. The acquisition, thought to be the largest ever pure private equity investment in the clean cooking technology sector, gives Circle Gas access to KOPAGAS's trademarked PAYG LPG technology. The investment will accelerate the scale-up of smart metered LPG, expanding the existing business in Tanzania and Kenya in 2020. The project in Kenya

will be supported by Safaricom, Kenya's leading mobile operator. Safaricom is also an investor in 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. This is the first time a mobile operator has invested in clean cooking solutions, recognising the commercial opportunity of mobile enabled utility services.

Find out more:

▶ Video: Affordable, clean cooking through mobile technology in Tanzania – KOPAGAS

📄 Report: *KopaGas: Mobile-enabled Pay-as-you-Cook Service in Tanzania*

🖥 Website: https://www.kopagas.com/

Peshawar: Confronting power outages and electricity theft

Peshawar is a city in northern Pakistan with a population of 1.2 million, and a surrounding population of approximately 2.1 million.[46] Peshawar is one of the largest recipients of refugees and internally displaced persons in South Asia, which has been driving rapid urbanisation. The city is experiencing high rates of poverty, both among refugees and urban residents, many of whom struggle to access basic services.[47]

In Pakistan, power utilities are struggling to meet the demands of the growing population and remain financially and commercially sustainable. Worn out and costly electricity infrastructure, combined with poor power load management, have sparked several energy crises.[48] Unreliable access to electricity throughout the country is the result of demand surpassing available supply, forcing systematic outages.[49] To prevent the system crashing from capacity overload, it is

not uncommon for utility providers to perform load shedding in neighbourhoods where the perceived ability to pay is lower, leading to mistrust, deteriorating service quality and electricity theft. Many electricity providers in the country, including the Peshawar Electric Supply Company (PESCO),[50] have difficulties measuring power usage and managing load control remotely,[51] and illegal connections and electricity theft from the distribution line are significantly reducing providers' revenues.[52] PESCO faced technical/line losses of 32.6 per cent and theft/administrative losses of 11.65 per cent in the overall infrastructure with Rs4 billion worth of electricity reported to have been stolen from PESCO in 2018.[53] Less profitable service provision also raises costs for customers as providers must offset production losses. In Peshawar, this has created a vicious cycle of rising electricity prices and power theft.[54]

Jazz: Mobile innovation helps tackle electricity theft

With over 59 million subscribers, Jazz is a leading mobile operator in Pakistan. Jazz is committed to supporting Pakistan's development objectives, such as enabling access to on-grid energy services and using mobile technologies to prevent the loss and theft of electricity. In partnership with the Centre for Intelligent Systems and Network Research (CISNR) and PESCO, Jazz has developed an anti-electricity theft solution. Enabled by remote monitoring technology provided by Jazz, the solution seeks to identify points of failure and theft locations. It will also address challenges such as load management to optimise the distribution network.

The line loss reduction and theft prevention solution offered by Jazz will target underserved neighbourhoods, such as informal settlements, which tend to suffer the most from incidents of theft and higher electricity bills. Mobile technology enables real time communication between the installed devices on transformers and distribution poles or boxes, and the central control system. Without the solution and control centre with real time communication, the electricity distribution company has to identify and resolve all transmission line related faults manually which is near to impossible due to understaffing and at times lack of technical expertise. The project was initially piloted in

an area covering over 25,000 consumers. Using smart electronic devices, utility providers such as PESCO are able to monitor the electricity supply chain, catch power thieves and put preventative measures in place to reduce losses. Preliminary results from Jazz's pilot suggest that the solution has already reduced technical and administrative losses from 32 to 27 per cent. There is considerable potential to reduce losses further if the solution is scaled and commercialised. It is estimated that it would only take PESCO 7.5 - 19 months to recover its investment in the solution.

Looking ahead: PESCO is currently analysing other regions affected by administrative and technical losses and is evaluating commercialisation to scale the solution as part of a potential national partnership between Jazz and CISNR. Once fully commercialised, the solution will be pitched to other utility companies operating in Pakistan.

Find out more:

▶ Video: Improving electricity grid services through smart metering - Jazz

🖥 Website: https://jazz.com.pk/

Lagos: Tackling power shortages and outages in Nigeria's megacity

Lagos is the most populous city in Nigeria with current population estimates ranging from 14 million people to up to 20 million people. The city has been experiencing a high rate of rural-urban migration, and pressures on land and physical facilities have increased[55] to the point where the city has initiated a large infrastructure project to build a new strip of land by pouring concrete off the shore of the coast. Despite government efforts to implement urban development policies, over two-thirds of the population live in one of the city's many overcrowded slums, lacking formal infrastructure and access to

basic utilities.[56] Progress is struggling to keep up with population growth and the demand for water and sanitation services. Given regulatory uncertainty and recurrent evictions, slum dwellers often lack the basic legal documents to improve their living situations.[57]

In Lagos, like much of urban Nigeria, urbanisation is outpacing the rate at which electrical grid extensions can be constructed.[58] Even those with access to the grid, approximately 55 per cent of the urban population, suffer from constant outages.[59] The productivity of small- and medium-sized enterprises

45. GSMA (2018), *KopaGas: Mobile-enabled Pay-as-you-Cook service in Tanzania.*
46. Population Stat (2019), *Peshawar, Pakistan Population.*
47. Mosel, I. and Jackson, A. (2013), *Sanctuary in the City? Urban Displacement and Vulnerability in Peshawar, Pakistan.*
48. Hussain, Z. (2018), *On Demand Electrical Power Load Management Service for Smart Meters Using GSM Technology.*
49. Ali, A. et al. (2018), *Do Reward and Reprimand Policies Work in Reducing Electricity Distribution Losses?*
50. The Express Tribune (2018), *Technology Tackling Power Pilferage, Overbilling in Peshawar.*
51. Zaheer Ud Din, A. et al. (2018), *Cost-Effective Telemetry for Energy Network of an Electricity Distribution Company: Part I.*
52. Khan, A. et al. (2018), *Designing and Modeling of Automated Anti-Theft Electricity Distribution System.*
53. The Express Tribune (2018), *Drive Against Power Theft Launched in K-P.*
54. Ali, A. et al. (2018), *Do Reward and Reprimand Policies Work in Reducing Electricity Distribution Losses?*

55. Akinwale (2018), *Urban Slums in Nigeria: Ensuring Healthy Living Conditions.*
56. Campbell, J. (2019), *Home to Over Half the Population, Nigeria's Cities Continue to Boom.*
57. Olajide, O. et al. (2018), *The Realities of Lagos Urban Development Vision on Livelihoods of the Urban Poor.*
58. Olurode, L. et al. (2019), *Urbanisation and Energy Crisis: the Case of Lagos State.*
59. Adegoke, Y. (2018), *The Cost of Electricity Shortages in Africa is More Than Just a Problem of Access.*

(SMEs) is limited by the number of grid blackouts and unstable connections. This is a major challenge for the urban poor in particular, as many tend to reside in informal settlements where operational electricity systems are severely lacking. Many urban residents in Lagos therefore use expensive gasoline generators, which cost about $8.30 for a day of fuel and produce hazardous air pollution in households.[60]

Lumos: Providing an affordable and reliable energy supply through PAYG solar

Lumos Global offers a clean, reliable and affordable solar energy solution for people and businesses living off the electricity grid. Its SHS 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 SHS is mobile-enabled through the use of airtime credit and GSM-based M2M connectivity, which allows people to take control of their payments and energy use.

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 SHS offering as a cleaner and more efficient alternative to widely used diesel generators. Lumos is leveraging MTN's footprint in the country by using more than 300 MTN stores as distribution and sales points for its SHS. After charging a modest joining and installation fee, Lumos customers pay a monthly fee (around $15) via mobile airtime, and Lumos can shut down systems remotely via M2M in the event of non-payment.

Looking ahead: Lumos has extended its services to Côte d'Ivoire, and in the coming years is planning to scale to other markets in the region. Lumos was awarded a $75 million grant by the Nigerian government to support its expansion and provide a quick and simple solution to the country's chronic energy deficit. Lumos is aiming to sell five million SHSs 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.

Find out more:

💬 Blog post: Why off-grid energy providers are increasingly paying attention to urban areas – insights from the DRC and beyond

📄 Report: *Lumos: Pay-as-you-go solar in Nigeria with MTN*

🖥 Website: https://www.lumos.com.ng/

Unaffordable or unavailable: Providing water services to the urban poor

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 water.[61] Although urban piped water access in South Asia is somewhat more advanced, many slum dwellers must rely on informal truck vendors, which can charge as much as 52 times the cost of piped water. In Karachi, Pakistan, the Karachi Water & Sewerage Board serves only 30 per cent of households with frequently intermittent water supply. As a consequence, many households rely on alternative water providers and pay much higher costs. Residents from Ghaziabad, a large informal settlement in Karachi, purchase water directly from a private reverse osmosis treatment plant at almost 50 times the cost of public water.[62] This creates a huge opportunity cost of both time (collecting water) and money, as the urban poor could have mobilised these resources to support other income-generating activities or improve their social welfare. Intensifying urban water scarcity in developing countries has led to the rise of private water tanker businesses, at a great cost to the urban poor (Figure 9). Estimates suggest that the private water fleet in Karachi, Pakistan might have doubled over the past decade, while it has more than quadrupled in Lagos, Nigeria, during that time.[63]

Figure 9   Source: World Resources Institute (2019)

Proportion of income needed for tanker truck water

**WHO-RECOMMENDED LIMIT FOR WATER AND SANITATION:
3–5% OF HOUSEHOLD INCOME**
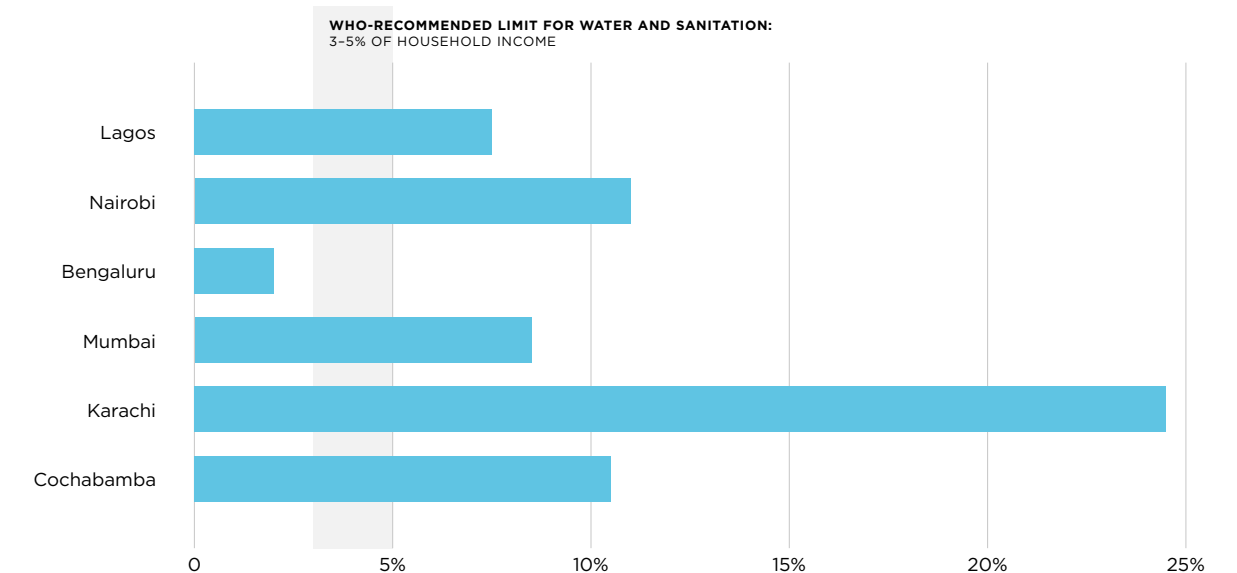
60. Osae-Brown, A. and Olurounbi, R. (2019), *Nigeria Runs on Generators and Nine Hours of Power a Day*.

61. World Bank (2019), *Which Way to Livable and Productive Cities*.
62. World Resources Institute (2019), *Unaffordable and Undrinkable: Rethinking Urban Water Access in the Global South*.
63. New York Times (2020), *The Merchants of Thirst*.

Current challenges will be amplified by climate change and urban population growth. According to the International Water Management Institute, urban water demand will increase 80 per cent between now and 2050. By then, nearly 5.7 billion people will face water scarcity for at least one month every year.[64] As "Day Zero" in Cape Town and other drought-affected cities have demonstrated, water restrictions and rationing schemes have a disproportionate impact on low-income populations and those living in informal settlements.[65] Meanwhile, rapid urbanisation has led to groundwater being extracted faster than it is replenished.[66] In cities with inadequate faecal sludge and waste management, groundwater can become contaminated if it is recharged with leakage from wastewater infrastructure. Urban communities that frequently rely on ground and surface water sources are increasingly vulnerable to consuming contaminated water. Water contamination is one of the primary sources of preventable diarrheal disease, which causes over 1.4 million child deaths annually, most of which are concentrated in Sub-Saharan Africa and South Asia.

These inequalities are further amplified by asymmetric government support. Although water and sanitation subsidies in low- and middle-income countries account for up to 1.5 to two per cent of combined GDP, they barely target the poor. According to the World Bank, 56 per cent of subsidies benefit the top 20 per cent of the population, while only six per cent of subsidies benefit the bottom 20 per cent.[67] While shocking, it is not entirely surprising since subsidies are currently designed to benefit those already connected to piped/sewered water and sanitation services (i.e. the wealthy and upper-middle classes). There is tremendous scope for innovative solutions to make subsidies smarter and more targeted, and to ensure they support wider sector reform.

Over the last 10 years, the proportion of urban poor with access to at least basic water services has actually decreased in some countries (see Figure 10). Rapid population growth, especially in informal settlements, are threatening important gains in clean water access, particularly in Sub-Saharan Africa. To achieve SDG 6, governments, donors and entrepreneurs will need to focus more heavily on innovative solutions to provide affordable and reliable water services to the urban poor.

Figure 10   Source: *Joint Monitoring Programme* (2017)

Proportion of urban poor with access to at least basic water services in selected African countries, 2007 to 2017.
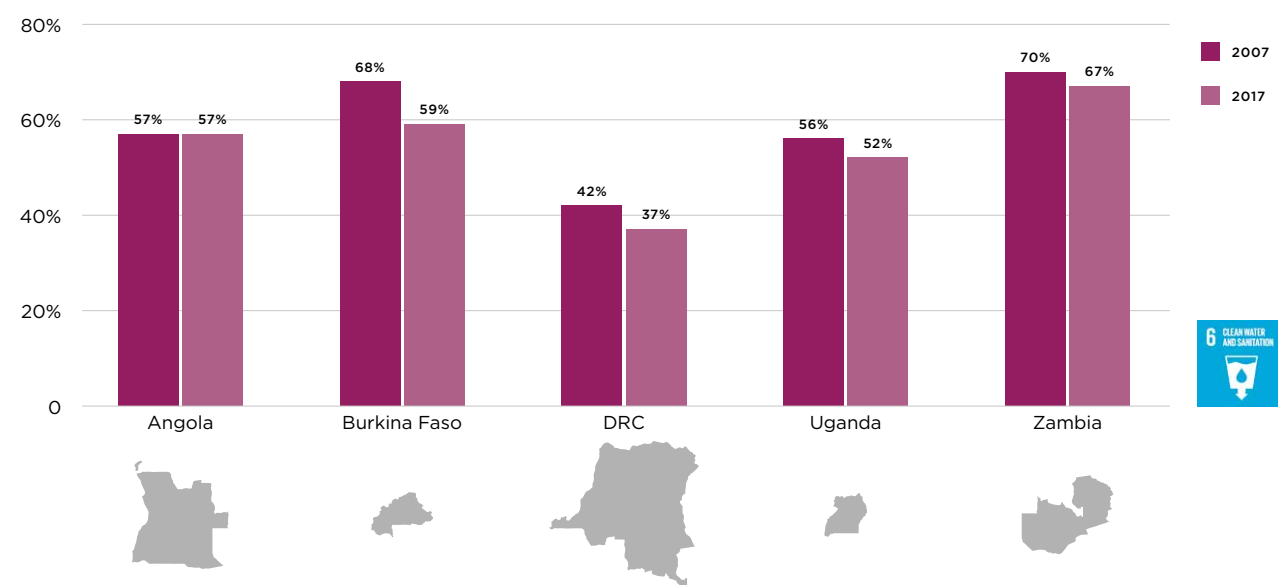
64. World Resources Institute (2019), *Unaffordable and Undrinkable: Rethinking Urban Water Access in the Global South*.
65. Overseas Development Institute (2018), *Politics, poverty, and climate change: stories from Cape Town's 'Day Zero'*.
66. Foster (2001), *The interdependence of groundwater and urbanisation in rapidly developing cities*.
67. World Bank (2019), *Doing More with Less: Smarter Subsidies for Water Supply and Sanitation*.

Niamey: Struggling to extend piped water to the urban poor

Niger is not only one of the poorest countries in the world, but also has one of the world's highest birth rates, with an estimated 7.2 children per woman.[68] Niamey, the capital city of Niger, is densely populated and home to a rapidly growing population of 1.2 million people.[69] Even though the city accounts for about 27 per cent of GDP, Niamey has struggled to deliver basic services to residents.[70]

Despite numerous reforms and marked improvements in access to safely managed water in urban areas of Niger in recent years, high rates of poverty and a growing population are widening the access gap between the wealthy and the underserved.[71] In Niamey, the expansion of private piped water has access has increased significantly over the years. However, while the city's pipe system and chemically treated water is distributed directly to richer neighbourhoods, the poorer peripheral settlements are still largely unconnected. Most urban poor are therefore forced to collect water from expensive and unreliable public water taps and water vendors.[72]

CityTaps: Enabling safe water access to the urban poor through prepaid smart metering

CityTaps is a social enterprise that has developed a solution to bridge the gap between water utilities and the urban poor. Its prepayment service uses a smart, prepaid water meter linked to an IoT platform, as well as a billing software. The solution leverages smart technology that allows customers to prepay any amount of water through a pay-as-you-go mobile model, and data from the meter is transmitted in real time through machine-to-machine (M2M) connectivity to keep track of usage. The data can then be monitored through the software management system to control payments and water access, and to provide notifications of thefts or leakages. The service is provided in collaboration with an affiliate branch of Veolia, SEEN, and Orange Niger. CityTaps has also been supported by OrangeFab France, Orange's start-up accelerator.

As of November 2019, CityTaps had installed 1,325 smart meters, and its users are receiving lower monthly water bills, an uninterrupted water supply and spending less time collecting and paying for water. Customers reported savings of up to 95 per cent of their spending on water from $3.37 per m^3 to $0.21 per m^3, and a reduction of 86 minutes spent collecting water on a daily basis (from over 90 minutes to under five minutes).

Looking ahead: As the cost of acquiring new meters is expensive for resource-constrained water utilities, CityTaps has developed an innovative pricing model based on a leasing contract that enables utilities to recover or spread out the costs of deploying smart meters. This model is currently being trialled in partnership with Orange Burkina Faso and Office National de l'Eau et de l'Assainissement (ONEA), the utility in charge of water and wastewater services in Ouagadougou. CityTaps has also been selected to participate in the OrangeFab France program, which will provide support to integrate and deploy the solution in other Orange-footprint countries, such as Mali and Senegal. Building on the project funded by the GSMA M4D Utilities Innovation Fund, CityTaps plans to scale to other markets throughout Africa with the aim of reaching two million people by the end of 2022.

Find out more:

▶ Video: Delivering water to urban homes through smart metering and mobile payments – CityTaps

📄 Report: *Mobile for Development Utilities Perspective – Our quarterly insights – Issue 1*

🖥 Website: https://www.citytaps.org/

68. The Conversation (2019), *Niger has the world's highest birth rate – and that may be a recipe for unrest.*
69. Population Stat (2019), *Niamey, Niger.*
70. World Bank Group (2018), *The Challenges of Urbanization in West Africa.*
71. Keough, S. and Youngstedt, S. (2019), *Water, Life and Profit.*
72. Keough, S. and Youngstedt, S. (2018), *'Pure' Water in Niamey, Niger: The Backstory of Sachet Water in a Landscape of Waste.*

Dhaka: A water utility struggling to cope with rapid urbanisation

With a population density of 44,500 people/km[2], Dhaka, the capital of Bangladesh, is one of the most crowded cities in the world.[73] Although Bangladesh's economy has been one of the best performers in the region over the last few years, growth has been highly unequal and overly concentrated in Dhaka. Slum dwellers make up over 40 per cent of Dhaka's population, while the government's reluctance to invest in cities beyond Dhaka has compounded the problem. The current urban growth trajectory has put a strain on housing, and basic service delivery, which, in turn, is extremely detrimental to the sustainability of the natural and built environment. The city faces chronic water congestion issues and an acute shortage of basic utility services, especially in the large informal and peri-urban settlements.

Dhaka's rapid growth and crippling density poses a profound challenge to utility service provision. As Tasqsem Khan, Managing Director of the Water Supply and Sewage Authority (DWASA) recently stated in an interview, "The reason why there is water congestion in

Dhaka city is because it's a megacity — its population growth is too high. DWASA once worked for six million people," he said, "but today there are about 15 million people … That is the reason why the natural water bodies and water drainage systems have been destroyed and housing has been built up."[74]

The arsenic water crisis in Bangladesh is one of the greatest public health challenges in the world, affecting about 13 per cent of water sources, and E.coli bacteria has further contaminated 41 per cent of all improved water sources in the country.[75] Due to the rapid expansion of the city's slums, many slum dwellers must rely on illegal connections or buy expensive low-quality water from informal traders, which often charge 15 to 20 times the DWASA rate.[76] Extending water connections to informal settlements is not only a logistical and financial challenge, but also raises legal questions since a 2007 government policy only recognises connections to community-based organisations, not individual households.

Drinkwell: A unique partnership model to bring safely managed water to the urban poor

Drinkwell is a water technology company that provides water ATM systems that disburse safe metered drinking water. In partnership with the DWASA and mobile operator Robi Aziata, Drinkwell has developed sensor-based turnkey technology that dispenses safe water through locally regenerable water filtration, which can be distributed through a digitally enabled water ATM solution. Customers can prepay for any amount of water on their Drinkwell NFC card, while water ATM caretakers use mobile money to transfer the money collected at their respective ATM stations.

Drinkwell has deployed over 200 water ATMs across Laos, India, Cambodia, Nepal and Bangladesh, reaching over 250,000 people. Its largest market presence is in Dhaka where it has deployed around 90 water ATMs. According to an endline survey of Drinkwell customers,

98 per cent reported being satisfied with the Drinkwell ATM system. The number of respondents reporting water-related health issues also decreased from 79 per cent during the baseline survey to 10 per cent in the endline survey 12 months later. The solution also benefited DWASA. Its partnership with Drinkwell led to a 10 per cent reduction in non-registered users who collect water from the WASA line (mostly illegally tapped) but do not pay for it, and a five per cent reduction in registered Dhaka WASA users. It also improved DWASA brand perception, with 90 per cent of users reporting a more positive perception of WASA because of the Drinkwell ATM system.

Looking ahead: In 2019, Drinkwell received investments from Danone, the Global Innovation Fund and Unilever to further scale the solution. Drinkwell

is also testing ways to enable customers to top up their Drinkwell cards via mobile money. In May 2018, Drinkwell secured a contract with DWASA to expand its services to 300 water ATMs in Dhaka, and another contract from the Water Supply & Sewerage Authority to pilot three water ATMs in Chittagong, Bangladesh. Drinkwell's vision is to deploy 1,500 ATMs and reach one million people by 2024.

Find out more:

Video: *Working towards SDG 6 through water ATMs in Bangladesh – Drinkwell*

Report: *Mobile for Development Utilities Perspective – Our quarterly insights – Issue 1*

Website: http://drinkwellsystems.com/

Under the radar: the world's urban sanitation challenge

As the Citywide Inclusive Sanitation[77] initiative stresses, urban population growth continuously outpaces gains in sanitation access. According to the World Bank, only 26 per cent of urban excreta is deemed to be safely managed. 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. Between 2000 and 2015, in 54 of 120 surveyed countries, growth in sewer access did not keep pace with urban population growth (Figure 11). With urbanisation in Asia, and particularly in Africa, poised to accelerate, extending sanitation services to the urban poor will be one of the most crucial public health challenges facing cities in developing countries over the next decades.

Figure 11   Source: SDG 6 Synthesis Report 2018 on Water and Sanitation

Urban population growth versus sewer coverage growth in urban areas, 2000–2015

73. World Economic Forum (2017), *These are the world's most crowded cities.*
74. The Guardian (2018), *The dysfunctional megacity: why Dhaka is bursting at the sewers.*
75. The World Bank (2018), *Bangladesh: Access to Clean Water will Reduce Poverty Faster.*
76. Asian Development Bank (2018), *The Dhaka Water Services Turnaround.*
77. Citywide Inclusive Sanitation (CWIS): https://citywideinclusivesanitation.com/
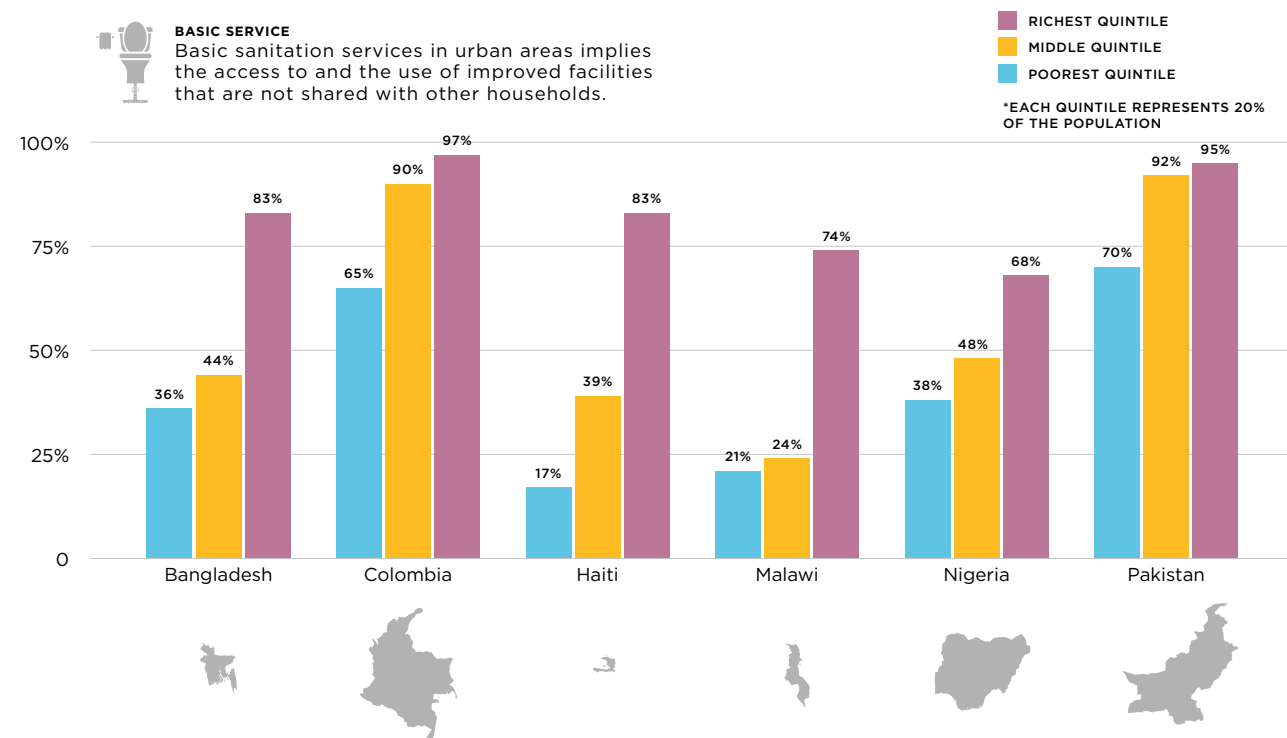
The lack of significant progress in urban sanitation service delivery has profound implications for cities in developing countries. Poor urban sanitation directly causes a range of negative impacts, such as water contamination, environmental degradation, poor school attendance and endemic disease, all of which can have extremely adverse consequences for sustainable urban development. Without adequate sanitation facilities, girls are more likely to drop out of school and are vulnerable to attacks while seeking privacy for sanitation needs. Recent analysis shows that ending open defecation can improve children's lives by reducing disease transmission, stunting and poor nutrition, which are important for childhood cognitive development and future economic productivity.[78] If there is not a radical shift in how urban sanitation services are funded, planned and designed, it will be impossible to achieve not only SDG 6 but also SDG 11 (Sustainable cities and communities).

Figure 12

Source: Joint Monitoring Programme (2017)

Percentage of people with access to at least basic sanitation services

BASIC SERVICE
Basic sanitation services in urban areas implies the access to and the use of improved facilities that are not shared with other households.

RICHEST QUINTILE
MIDDLE QUINTILE
POOREST QUINTILE

*EACH QUINTILE REPRESENTS 20% OF THE POPULATION

	Bangladesh	Colombia	Haiti	Malawi	Nigeria	Pakistan
Poorest	36%	65%	17%	21%	38%	70%
Middle	44%	90%	39%	24%	48%	92%
Richest	83%	97%	83%	74%	68%	95%

This shift must be grounded in the realities facing the urban poor. The vast majority rely on non-sewered sanitation — a sanitation system that is 1) not connected to a networked sewer system; and 2) collects, conveys and fully treats the specific input to allow for safe reuse or disposal of the generated output. Many are willing or already paying for private or unregulated sanitation services. Cities with large informal settlements therefore require innovative approaches to sanitation service provision, "which can complement, or precede the arrival of, traditional sewers and conventional on-site solutions, and thus contribute to the realisation of the sanitation-related SDGs."

Yet, in the absence of coordination tools, these approaches are often extremely complex, requiring significant logistics and communication between different stakeholders, from households to pit emptiers and municipalities. This can lead to problems of accountability and transparency, such as illegal dumping of waste into the environment.

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78. Cumming and Cairncross (2016), *Can water, sanitation and hygiene help eliminate stunting? Current evidence and policy implications.*

Antananarivo: Struggling to provide sanitation and faecal sludge management services

Antananarivo is the capital city of Madagascar, home to 1.3 million people — a figure that increases to three million if the peri-urban and metropolitan areas surrounding the city are included.[79] Poverty is prevalent throughout the city, with approximately a third of the population living in informal settlements and more than a million lacking access to improved water and sanitation services.[80]

Only 11 per cent of Madagascar's population use basic sanitation facilities, and sewerage systems and pit latrines are limited.[81] Poor faecal sludge and waste management in the dense urban area of Antananarivo pose a significant health risk from disease and land degradation, as waste is often disposed of without proper treatment.[82] Approximately 44 per cent of the population in Antananarivo practice open defecation, while over 3,800 children in the city die from diarrheal disease every year as a result of poor water, sanitation and hygiene.[83]

Loowatt Loowatt: Preventing sludge from going to waste

Loowatt offers a waterless flush toilet system and sanitation solution for off-grid households. The toilet is a basic structure consisting of a seat connected to an odourless cartridge with a biodegradable lining that can be safely and hygienically collected for transport and treatment in an anaerobic digester. Not only do the toilets save water, the closed loop system also treats the waste and transforms it into fertiliser, electricity and biogas, providing vital clean energy sources. Loowatt's app and web-based platform provide a mobile tool to manage waste services, allowing the team to easily communicate with customers, monitor and schedule waste collection or toilet servicing, and track mobile money payments for refill liners in partnership with Airtel Madagascar.

Loowatt toilets have been used by over 100,000 customers, and over 200 tonnes of faecal sludge have been transported and treated in the closed-loop system. In Antananarivo, 70 per cent of Loowatt's custmer base is female. By leveraging mobile solutions for logistics (mobile app) and payment collections (mobile money), Loowatt has been able to scale, cutting its operational costs by 15 to 25 per cent while servicing and maintaining over 100 toilets in Antananarivo.

Looking ahead: Following a successful pilot, in November 2018, Loowatt entered a partnership with Laguna Water to roll out the Laguna Portable Toilet Solution (PTS) in the Philippines. The partnership is a first-of-its-kind utility business model for non-sewered household toilets, and a signal that governments, regulators and service providers in emerging markets are embracing new ways of delivering services. As Loowatt founder and CEO Virgina Gardner said in a recent interview on Loowatt's future, "The key to sustainability is working with local governments and municipal service providers who are already providing services to cities.[84]"

Find out more:

▶ Video: Supporting waterless flush sanitation through mobile technology – Loowatt

▭ Report: *Loowatt: Using mobile tools to support the provision of urban sanitation services in Madagascar*

▣ Website: https://www.loowatt.com/

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79. World Population Review (2019), *Population of Cities in Madagascar.*
80. Water & Sanitation for the Urban Poor (2019), *Antananarivo: Improving Services across Madagascar's Capital City.*
81. WHO/UNICEF JMP Global Database (2017), *Madagascar.*
82. Deutsche Welle (2019), *Improving Access to Clean Water in Madagascar.*
83. Jones, D. (2018), *No to Fragmentation and Isolated Action" - Integrating Child Health and Water, Sanitation and Hygiene in Madagascar.*
84. Devex (2019), *Q&A: WASH Business: A waterless toilet waste-to-value set to scale.*

Kampala: Seeking a virtuous cycle for waste collection and management

Kampala is the capital of Uganda, with 1.3 million residents in the city proper.[85] Without an appropriate urban policy framework in place, unplanned urbanisation is steadily increasing,[86] and not in conjunction with industrialisation and job creation.[87] The wider metropolitan area of Kampala has approximately 3.5 million residents, and is characterised by large informal settlements, insecure land tenure and poor infrastructure. For the urban poor, these settings have made them particularly vulnerable and isolated from services, such as access to improved sanitation services.[88]

Sanitation services are under particular pressure in Kampala, with 94 per cent of the city relying on non-sewered sanitation. Often, the only alternative for people living in informal settlements is a decentralised system of pit latrines and septic tanks. Without formal collection and treatment services available, these pit latrines 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.

KCCA: Using GIS technology to optimise pit emptying in Kampala

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 interventions. KCCA has also worked with MTN

Uganda to promote mobile money as a tool for pit emptiers to collect and process payments.

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 received a grant from USAID Grand Challenges program to build on the existing GIS platform to map informal settlements and subsidise emptying pits jobs in the informal settlements. In order to further expand this digital-enabled sanitation

solution, KCCA will develop a customer facing app to request the service directly through the app. This will be funded by a grant from the Bill and Melinda Gates Foundation. KCCA is also 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. The 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.
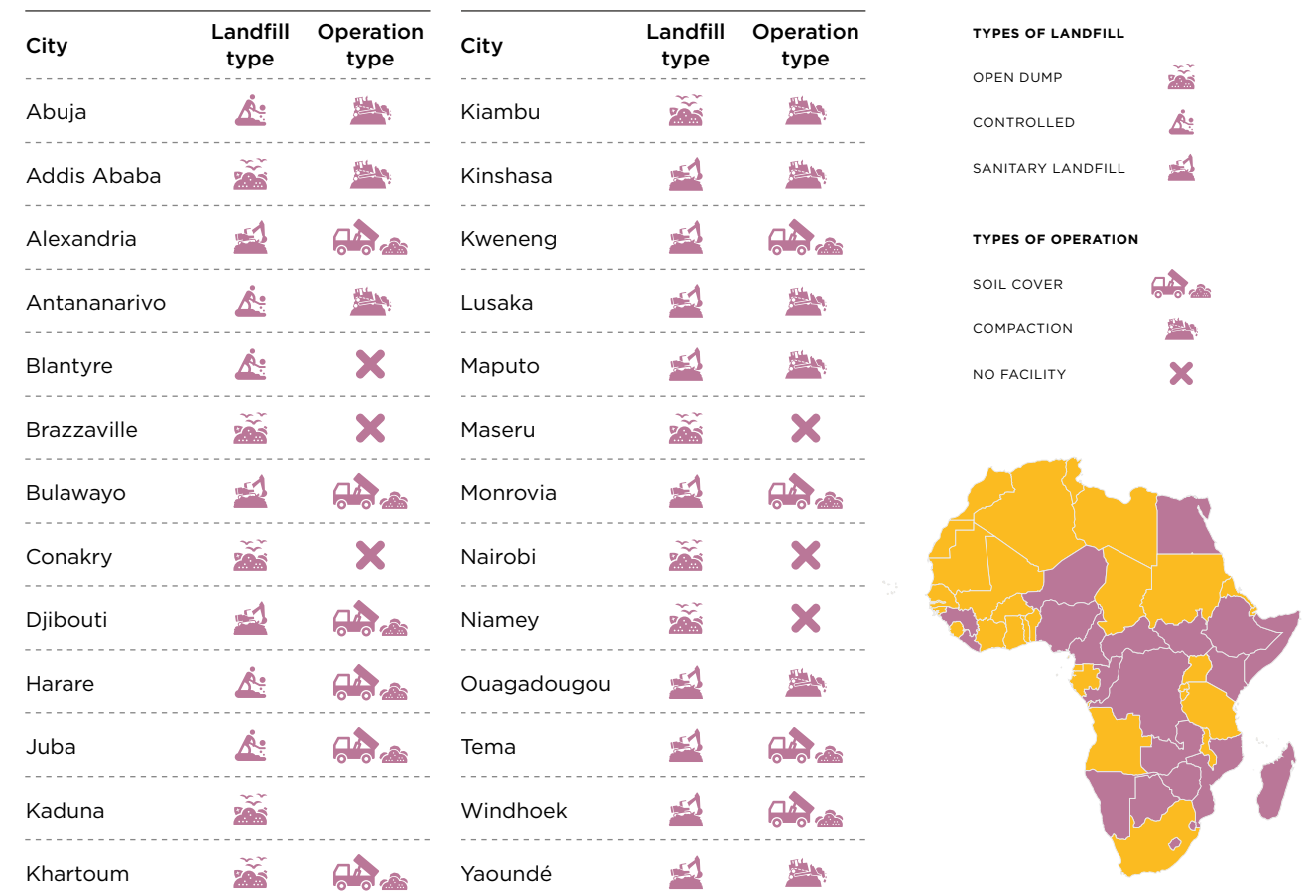
Find out more:

▶ Video: Providing pit emptying services through a GIS-enabled app – KCCA

📄 Blog post: *Kampala Capital City Authority – Unlocking the power of mobile-enabled Sanitation*

🖥 Website: https://www.kcca.go.ug/

More people, more municipal waste: The dirty reality of rapid urbanisation in developing countries

Figure 13   Source: African Clean Cities Platform (2019), *Africa Solid Waste Management Data Book 2019*

The state of waste collection and management across major African cities

City	Landfill type	Operation type	City	Landfill type	Operation type
Abuja			Kiambu		
Addis Ababa			Kinshasa		
Alexandria			Kweneng		
Antananarivo			Lusaka		
Blantyre		✕	Maputo		
Brazzaville		✕	Maseru		✕
Bulawayo			Monrovia		
Conakry		✕	Nairobi		
Djibouti			Niamey		✕
Harare			Ouagadougou		
Juba			Tema		
Kaduna			Windhoek		
Khartoum			Yaoundé		

TYPES OF LANDFILL

OPEN DUMP

CONTROLLED

SANITARY LANDFILL

TYPES OF OPERATION

SOIL COVER

COMPACTION

NO FACILITY   ✕

85. World Population Review (2019), *Uganda Population 2019*.
86. Bidandi, F. and Williams, J. (2017), *The Challenges Facing Urbanisation Processes in Kampala*.
87. Gollin, D. and Haas, A. (2016), *Kampala, Where Urbanisation is not Synonymous with Industrialisation*.
88. Richmond, A. et al. (2018), *Urban Informality and Vulnerability: A Case Study in Kampala, Uganda*.

Waste is not only a developing country issue. It affects everyone in the world and is closely tied to economic growth, as more disposable income leads to more consumption and more waste. The World Bank predicts that global annual waste will increase to 3.4 billion tonnes by 2050, a third of which will be disposed of in unregulated dumps or burned in the open.

Failure to find waste management solutions will likely have a severe impact on the urban poor. In low-income countries, where city authorities are struggling with policy priorities in the context of scarce public resources, waste management practices remain highly unregulated, and most of the budget allocated to solid waste management is for collection rather than processing. Without an accountable management system, improperly controlled collection sites are often left abandoned and create a public health hazard. Meanwhile, most cities have not seized the potential of circular value chains, which use solid waste (as well as faecal sludge) as resources for waste-to-energy and waste-to-fertiliser use cases. A counter example is Addis Ababa's newly launched waste-to-energy treatment plant, which transforms over 1.4 million kg of waste into energy every day.

Growth in solid waste generation across developing countries
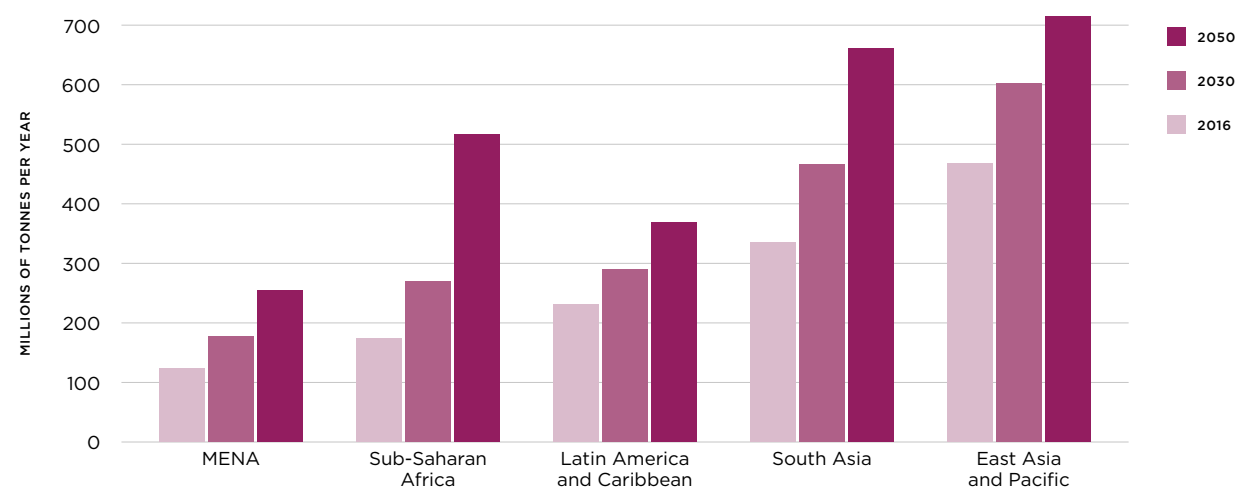
According to the World Bank, 93 per cent of waste in low-income countries is left in open dumps and there are normally no processing facilities. As solid waste treatment usually falls under the authority of local governments, limited financial resources and technical capacity are critical barriers to addressing this issue. However, waste generation is positively correlated with economic growth and is projected to grow significantly across developing countries (Figure 14). Excluding India and China, Sub-Saharan Africa will be the largest waste-generating region by 2050.

Waste management remains a labour-intensive practice, dominated by informal pickers who work daily in hazardous conditions on unsafe open dumps and landfills, running the risk of being killed by collapses or fires. A study by the African Clean Cities Platform reports that between 2016 and 2019, over 250 deaths in Ethiopia, Benin, Guinea-Conakry and Mozambique were due to landfill fires or collapses.

According to Women in Informal Employment: Globalizing and Organizing, one per cent of those in informal employment in developing countries make their living from waste management.[89] These activities range from collecting to recycling and compacting. In addition to the implicit risks of the job, informal waste pickers lack social protections, such as health insurance, pensions and access to credit, even though this work is their main source of employment and removing waste provides significant social benefits. A lack of public money and governance are two key factors contributing to keeping these workers on the margins.

Abidjan: A looming waste crisis

Abidjan is the biggest city in Côte d'Ivoire, with a population of about 4.5 million in the city proper, or 5.1 million including the wider metropolitan area.[90] Since independence, the pace of urbanisation has increased consistently, and while the economy has experienced sustained growth, the distribution of wealth has been uneven as poverty rates have only dropped slightly.[91] From 2000 to 2011, the country experienced a sociopolitical crisis in which people from rural areas migrated to the cities to escape poverty and civil conflict, settling mainly in disadvantaged and poorly managed peri-urban neighbourhoods and informal settlements around Abidjan.[92]

In Abidjan, over 288 tonnes of plastic waste are produced every day, less than five per cent of which is recycled.[93] 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 and 1,500 tonnes of e-waste, none of which was dealt with by collection stations or dismantling or treatment facilities.[94] 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 city.[95] 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 surrounding environment.

Coliba: Leveraging the dynamic informal sector and mobile incentives to manage waste

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'Ivoire.[96]

Looking ahead: In collaboration with Voltic Mineral Water, Coliba is planning to build an additional 160 recycling centres in Côte d'Ivoire in the coming years, expanding their contribution to the circular economy. By 2025, Coliba aims to reach more than two million users.

Find out more:

▶ Video: GSMA Ecosystem Accelerator Innovation Fund: Coliba

📄 Report: *Ecosystem Accelerator Compass – Insights on Start-ups and Mobile in Emerging Markets*

🖥 Website: http://www.coliba.ci/

89. International Labour Organization (2018), *More than 60 per cent of the world's employed population are in the informal economy.*

90. World Population Review (2019), *Ivory Coast Population 2019.*
91. The World Bank (2019), *Côte d'Ivoire Economic Outlook: Understanding the Challenges of Urbanization in Height Charts.*
92. Angoua, E. (2018), *Barriers to Access Improved Water and Sanitation in Poor Peri-Urban Settlements of Abidjan, Côte d'Ivoire.*
93. UNICEF (2019), *A Future for Every Child by Beating Plastic Pollution.*
94. Global Recycling (2018), *Ivory Coast: Waste Management is Still a Problem Child.*
95. Amnesty International (2018), *A Toxic Legacy: The Case for a Medical Study of the Long-Term Health Impacts of the Trafigura Toxic Waste Dumping.*
96. One Young World (2019), *Coliba, Ghana.*

Urban transport systems: What must change to encourage social mobility and mitigate pollution

Mobility, the ability of people to move around centres of interest, is often defined by the availability of public and private transport, and encompasses several aspects of urban sustainability, including access to employment and health facilities. According to the World Bank, across Africa, the population in the lowest income quintile spend about 60 per cent of their income on food and cannot afford to commute to the inner city from informal and peripheral settlements to find a job. The Asian Development Bank estimates that the cost of road congestion in Asian economies amount to two to five per cent of GDP every year due to lost time and higher transport costs. Air pollution levels in many Asian cities are also among the highest in the world, with up to 80 per cent attributable to the transport sector.[97] Investment in transport services is therefore a determining factor of inclusive cities, as limited mobility tends to harm the poorest and leads to negative externalities, such as crime and exclusion from basic services.
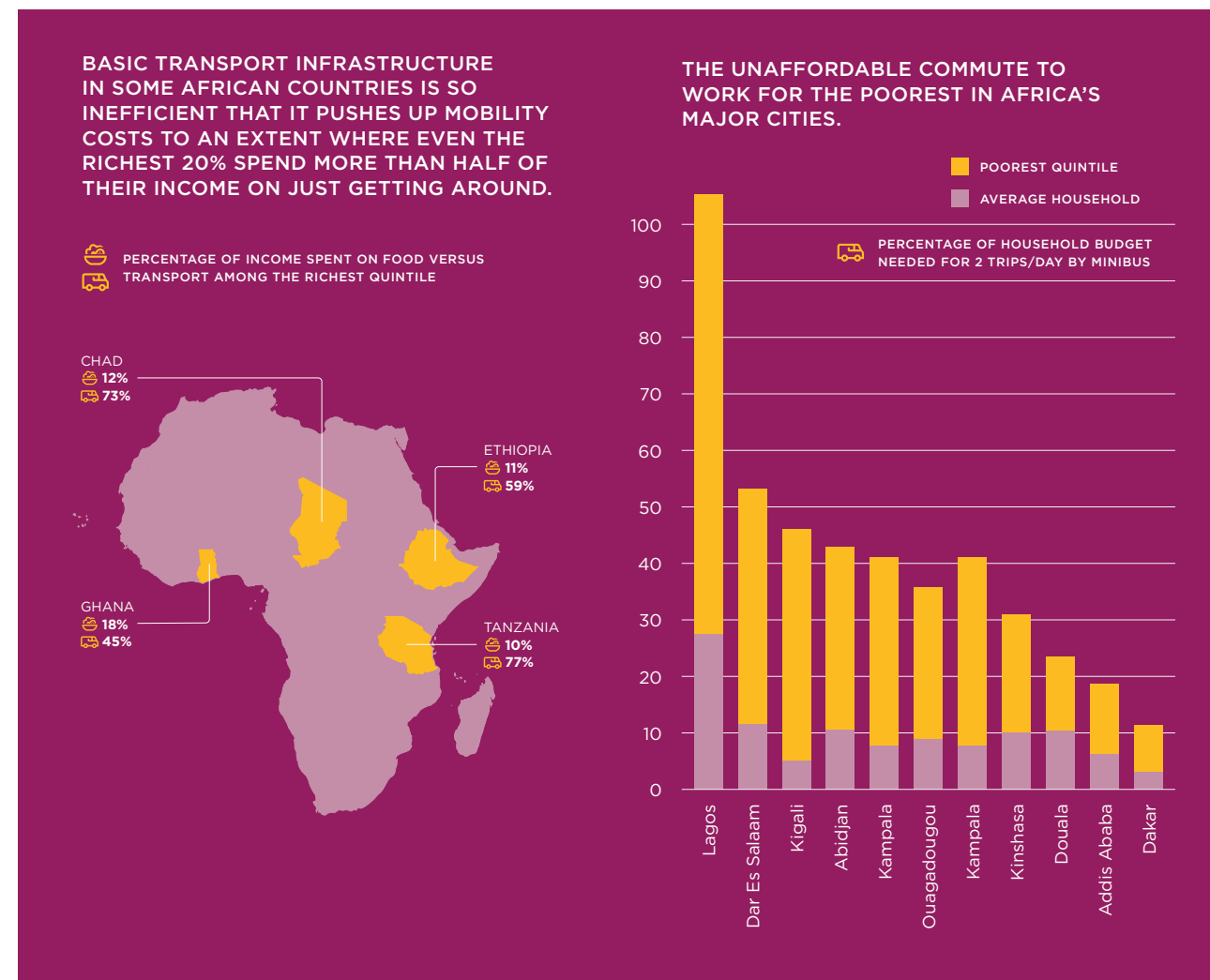
The lack of formal public transport and low share of income allocated to transport means that rapid urbanisation in developing countries is often characterised by non-motorised transport on the one hand, and a notable increase in the number of private cars, heavy pollution and congestion on the other. This is compounded by lacking regulation against heavily polluting vehicles and lagging progress on infrastructure projects needed to absorb the higher number of vehicles in the streets.

The cost of collective motorised urban transportation, which in developing countries is often dominated by informal minibuses, is high relative to household budgets in major cities, making it a largely unaffordable daily expense, especially for the poorest. In eight of 11 cities studied by the World Bank, the average household could not afford one round trip a day using the minibus network. Figure 15 shows the percentage of an 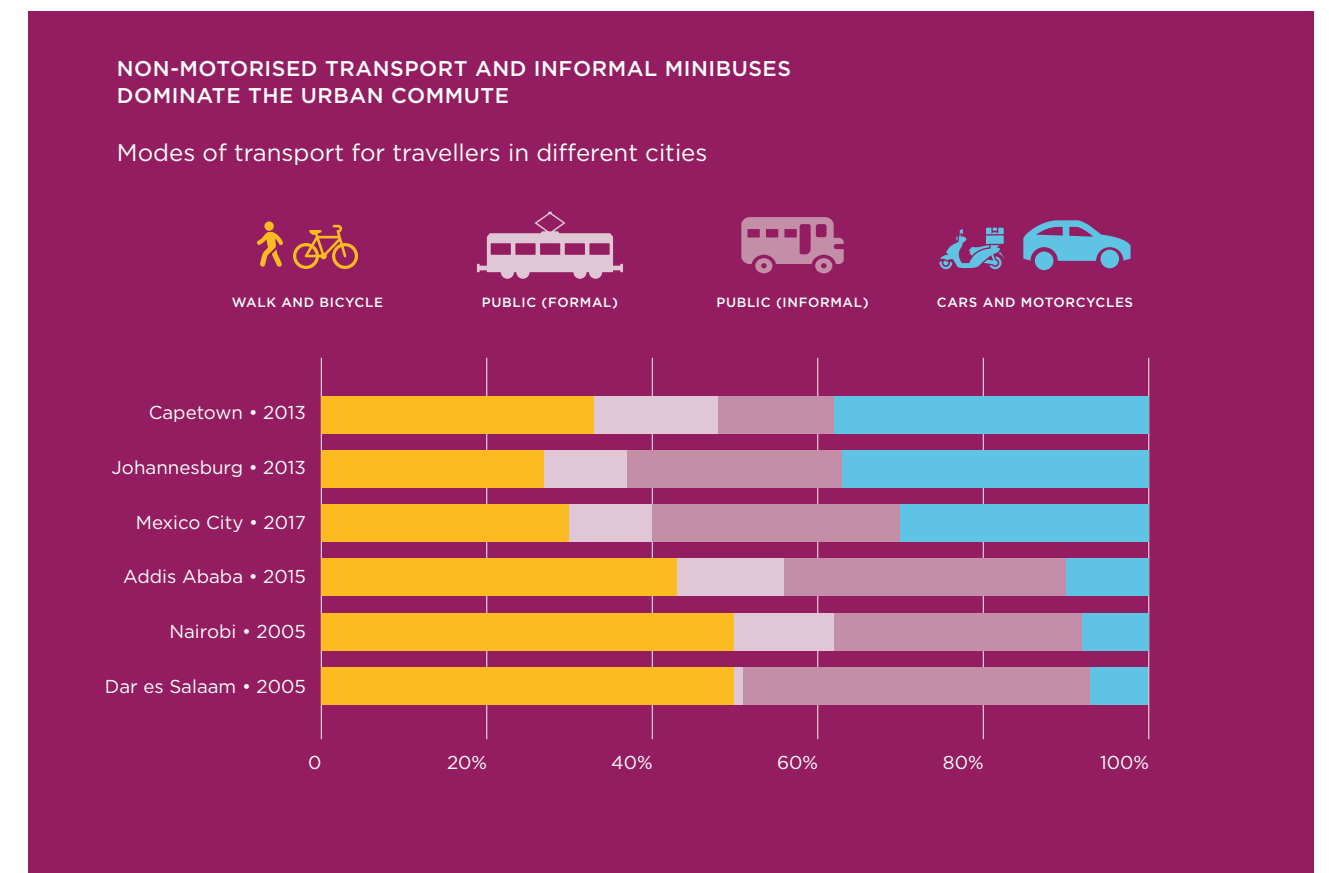average household budget spent on transport across different African cities and compares it to the transportation costs facing the bottom 20 per cent of the income distribution.

There is significant variation. In Dakar, a round-trip commute represents just 3.1 per cent of an average household's total expenditures. For most other cities, it is 5.1 to 27.5 per cent. For the bottom quintile, the situation is even worse. Excluding Dakar, the poorest households in these cities would need to spend an average of about 19 per cent of their budget to afford a round-trip motorised commute. For the lowest quintile, the figure is 53 per cent in Dar es Salaam and more than 100 per cent in Lagos.

More recent research has also shown that low-income residents are less likely to live near matatu stops. For instance, in Nairobi, an average of 79 per cent of the city lives within 0.5km of a matatu, but only 50 per cent of low-income residents are located near stops.[98]

Figure 15   Source: World Economic Forum (2015); The World Bank (2008), Stuck in traffic: urban transport in Africa

Transport costs across Africa

BASIC TRANSPORT INFRASTRUCTURE IN SOME AFRICAN COUNTRIES IS SO INEFFICIENT THAT IT PUSHES UP MOBILITY COSTS TO AN EXTENT WHERE EVEN THE RICHEST 20% SPEND MORE THAN HALF OF THEIR INCOME ON JUST GETTING AROUND.

PERCENTAGE OF INCOME SPENT ON FOOD VERSUS TRANSPORT AMONG THE RICHEST QUINTILE

CHAD 12% 73%
ETHIOPIA 11% 59%
GHANA 18% 45%
TANZANIA 10% 77%

THE UNAFFORDABLE COMMUTE TO WORK FOR THE POOREST IN AFRICA'S MAJOR CITIES.

POOREST QUINTILE
AVERAGE HOUSEHOLD
PERCENTAGE OF HOUSEHOLD BUDGET NEEDED FOR 2 TRIPS/DAY BY MINIBUS

Figure 16   Source: World Resource Institute (2019)

Commuting routes across selected cities in developing countries

NON-MOTORISED TRANSPORT AND INFORMAL MINIBUSES DOMINATE THE URBAN COMMUTE

Modes of transport for travellers in different cities

WALK AND BICYCLE   PUBLIC (FORMAL)   PUBLIC (INFORMAL)   CARS AND MOTORCYCLES

Capetown • 2013
Johannesburg • 2013
Mexico City • 2017
Addis Ababa • 2015
Nairobi • 2005
Dar es Salaam • 2005

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97. Asian Development Bank, https://www.adb.org/sectors/transport/key-priorities/urban-transport

98. World Resources Institute (2019), Integrated Transport Opportunities in Africa A Review of Nairobi and Kampala

São Paulo: Leveraging big data to mitigate peak traffic and reduce pollution

The metropolis of São Paulo has a population of over 21.7 million.[99] Over the years, much of the natural vegetation has been replaced with informal settlements, or favelas, in the periphery of the city, which are often not connected to basic infrastructure and utilities. Whereas the urban poor are particularly disadvantaged in terms of water, sanitation and electricity services, the impact of uncontrolled urbanisation on air pollution is a city-wide environmental issue.[100]

According to the World Health Organization, São Paulo is one of the most polluted cities in the world.[101]

Despite carbon monoxide levels dropping 20-fold from 1988 to 2015, in part as a result of public policies to use more energy-efficient and sustainable vehicles, light and heavy cars, motorcycles and rising fuel consumption continue to push up air pollution levels in the city.[102] The extensive use of motor vehicles, combined with its topography and exposure to the effects of climate change, makes the city uniquely vulnerable to air pollution.[103] Not only do high levels of air pollution pose significant respiratory health risks, a recent study by researchers at the University of São Paulo also suggests that atmospheric pollutants also stunt tree growth in the city.[104]

Telefónica: Data and forecasting algorithms for a cleaner city

Telefónica Brasil is a leading telecommunications company in Brazil. It has partnered with the municipalities of São Paulo to combat the adverse effects of pollution by harnessing their mobile network and using algorithms to collect, monitor, analyse and predict data patterns, in combination with information gathered from weather, traffic and pollution sensors in the city.

The anonymised big data on mobility provided by Telefónica allows authorities to calculate proxy values for the volume and flow of vehicles on the road, and enables them to take preventative steps and plan targeted interventions if pollution levels rise. For the urban population, this could mean less exposure to hazardous emissions, as the solution allows pollution warnings to be issued. Better traffic control decisions can also improve urban transport, both for city residents and those living in the periphery.

Looking ahead: Telefónica seeks to increase the value, accuracy and robustness of its data by improving the quality of the algorithms and predictive tools, generating insights from the data and making the model for pollution monitoring using mobile networks more scalable.

Find out more:

▶ Video: Big Data for Social Good – GSMA

📄 Report: *Predicting air pollution levels 24 to 48 hours in advance in São Paulo, Brazil*

🖥 Website: https://www.vivo.com/

99. World Population Review (2019), *São Paulo Population 2019*.
100. Narcizo de Lima, G. and Rueda, V. (2018), *The Urban Growth of the Metropolitan Area of São Paulo and its Impact on the Climate*.
101. WHO (2019), *Pollution Pods at COP25 show climate change and air pollution are two sides of the same coin*.
102. Freire, D. (2017), *Danger in the Skies of São Paulo*.
103. Atkinson, A. et al. (2019), *The Challenge of Environmental Management in Urban Areas*.
104. Locosselli, G. et al. (2019), *The Role of Air Pollution and Climate on the Growth of Urban Trees*.

Insights: What makes mobile-enabled urban innovations succeed

Our support of mobile-enabled innovations in urban contexts through the GSMA Mobile for Development Utilities Innovation Fund, has generated valuable insights about what drives success:

1. **Synergies between mobile operators, start-ups and utility service providers can form the basis of win-win partnerships that deliver value to all stakeholders**

   ○ Leveraging the market presence, brand recognition and distribution network of mobile operators can help start-ups and utility providers scale their services and communicate with customers in harder to reach informal settlements.

   ○ Facilitating mobile money integrations with start-ups, utility service providers, allows mobile operators to drive mobile money usage. It also helps them to reach new customer segments and drive mobile money penetration.

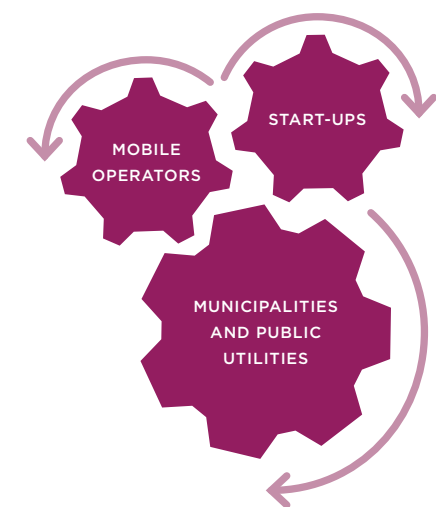2. **Mobile technology can unlock sustainable business models**

   ○ Pay-as-you-go SHSs in the energy sector, or pay-as-you-go prepaid smart meters in the water sector, can make essential utility services affordable to low-income populations.

   ○ In sectors where low-income populations display a relatively lower willingness to pay, such as sanitation, mobile-enabled loans, subsidies, and performance-based financing arrangements can help governments and donors effectively reach their social objectives.

   ○ Using mobile rewards systems can encourage people to participate in socially beneficial practices, such as waste management and recycling.

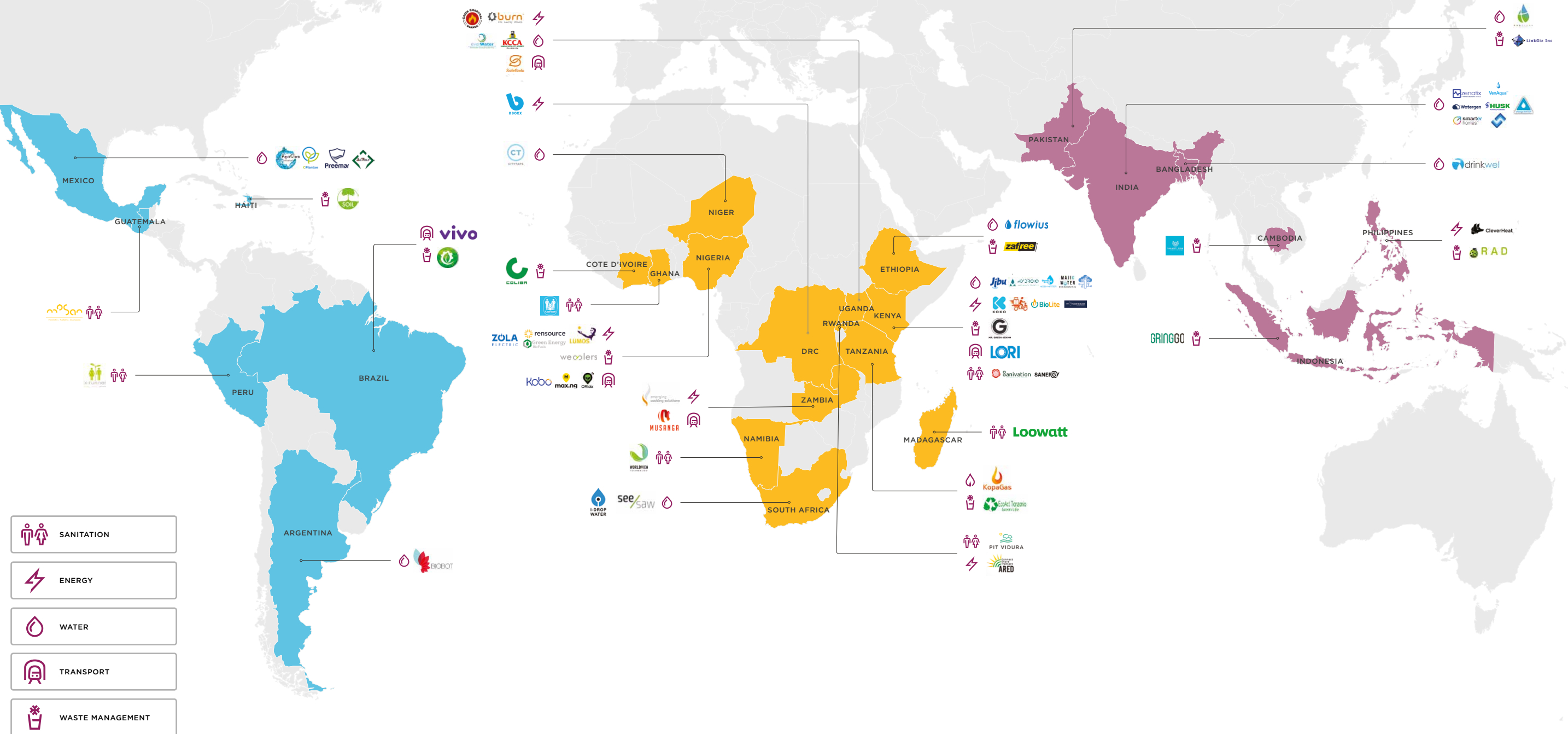3. **Regulatory clarity allows entrepreneurs to take bets and facilitates long-term investment decisions**

   ○ Governments may have to update regulations on the basis of innovations in basic service delivery. Container-based sanitation, ride sharing, or pay-per-use water ATMs are quite new solutions that can only reach scale if there is regulatory clarity.

4. **Digital solutions are not a panacea, and have to be tailored to the context in which they're being implemented**

   ○ Innovators have to anticipate relevant digital literacy, product design, or affordability barriers that certain digital solutions might face.

   ○ The political will to digitise and the institutional capacity to integrate and support innovative digital solutions varies across contexts.

   ○ Mobile connectivity or the penetration of mobile-enabled innovations might vary across different contexts.

   ○ Awareness, convenience, trust and reliability are key to ensuring that customers buy into innovative solutions to basic service provision.

MOBILE OPERATORS

START-UPS

MUNICIPALITIES AND PUBLIC UTILITIES

INNOVATORS IN DEVELOPING COUNTRIES ARE ADRESSING URBAN CHALLENGES THROUGH TECHNOLOGY

MEXICO

GUATEMALA

HAITI

PERU

BRAZIL

ARGENTINA

COTE D'IVOIRE

GHANA

NIGER

NIGERIA

ZAMBIA

NAMIBIA

SOUTH AFRICA

DRC

UGANDA

RWANDA

TANZANIA

KENYA

ETHIOPIA

MADAGASCAR

PAKISTAN

INDIA

BANGLADESH

CAMBODIA

PHILIPPINES

INDONESIA

SANITATION

ENERGY

WATER

TRANSPORT

WASTE MANAGEMENT

A city is comprised of its citizens, local businesses and government, together with the services and infrastructure to help them go about their daily lives. These include transport, security, communications, housing and more. To create opportunities for economic growth, a city needs to build the right operating environment for private sector development, deliver meaningful local services to its citizens, and attract talent and new investment.

Although this report has focused on the urban poor, it is important to recognise that poverty is multi-dimensional. It cannot merely be reduced to income, but must also take into account and respond to other systems of exclusion that discriminate against people based on gender, identity or disability. Mobile technologies can be critical in highlighting the complex and multi-dimensional challenges facing the urban

poor, and can help inform intersectional and tailored responses to their challenges.

Partnering with mobile operators can be key to unlocking the potential of innovative technologies and delivering sustainable solutions across cities and contexts. The GSMA Mobile for Development programme, as well as the wider GSMA and its members, are committed to working with governments, city councils and other private sector stakeholders to develop smart solutions for cities that deliver real, long-term benefits to all their citizens. The following is an overview of some of our past and ongoing initiatives, which shows how mobile-enabled digital identity, assistive technology use cases and our effort to close the mobile gender gap, are helping to make cities work for everyone.

Beyond basic service provision: Leveraging mobile for inclusive cities

Why digital identity is key to the lives of the urban poor

As the world continues to urbanise, sustainable development will require governments to work alongside public and private sector partners to develop policies, practices and services that provide the urban poor with equitable access to housing, education, healthcare, financial services, mobile connectivity and decent work. Central to these efforts will be ensuring that all segments of society are able to obtain, and meaningfully use, official proof of identity.

Given that migration is considered a key contributor to urban population growth in Asia and Africa, identification can be a challenge with fluid populations constantly on the move. The World Bank has highlighted that the urban poor, particularly migrants and unregistered youth, can become digitally, socially and financially excluded when they do not have formal title or registration as a resident, lack official identification documents or cannot provide a valid proof of address. The unique identity needs of a person living in urban poverty can be influenced by a range of factors, such as their family and housing situation, social capital, place of origin (if they migrated), level of education, access to employment and overall financial stability.

Many urban dwellers are entrepreneurial, effective at managing and coping with uncertainty, and increasingly turning to mobile platforms to access information and maintain (or establish) social connections. Others, however, will be financially

desperate, distrustful, less digitally savvy and have little bargaining power when it comes to enforcing their rights or accessing entitlements.

Entrepreneurs and owners of informal SMEs, many of whom are women, represent a crucial and sizeable component of many economies. This is particularly true in Nigeria, where SMEs are believed to constitute over 90 per cent of all businesses. Although these enterprises play an important role in society and the economy, their potential is often constrained by a lack of meaningful identification (ID). In particular, business owners find it difficult to highlight the legitimacy of themselves and their firms, and to demonstrate their trustworthiness and credibility. This often leaves them unable to access business support services, source new customers and suppliers and grow their businesses.

Given high levels of mobile penetration in informal settlements, there is tremendous scope to leverage mobile data to construct digital profiles, which can function as de facto ID. In Lagos, the GSMA's Digital Identity programme explored how to leverage the central role of mobile phones in the Nigerian informal economy to create alternative "economic IDs" for SMEs. Informal traders frequently use mobile phones to negotiate with suppliers and distributors, to market and sell products (including on digital marketplaces and via social media) and to make and receive payments via banking apps, or through the growing

use of mobile money. In this context, combining mobile phone data, including mobile credit top-ups and usage information, with other data sources gives an SME the potential to create a digital profile. This profile would function as an economic ID, communicating the credibility, trustworthiness, reliability and strength of an enterprise to customers and suppliers.[105]

Closing the mobile gender gap: putting women at the centre of urban utility service delivery

While this report has highlighted many challenges that cities throughout the developing countries face, they also offer important opportunities to minorities and vulnerable groups particularly women. Though inequalities between men and women persist in urban areas, the relatively lower mobile gender gap offers important opportunities.

In survey results from the GSMAi Consumer Survey 2019, the mobile device ownership gender gap in Mozambique was significantly lower in urban areas (at 11 per cent) than in rural areas (20 per cent). Similarly, the mobile internet gender gap in Pakistan was more than twice as pronounced in rural areas (62 per cent) than in urban areas (29 per cent). Many of the barriers to owning a mobile phone and accessing mobile internet (affordability; literacy and skills; relevance; safety and security; accessibility) are accentuated in rural areas.[106]

The relatively lower mobile gender gap in urban vis-à-vis rural areas is an opportunity for urban innovators to also reduce gender inequalities in the provision of basic urban services. For instance, recent research has shown that increased access to sanitation loans, is giving women the opportunity to invest in sanitation solutions that address their menstrual hygiene and other needs.[107] Providing access to mobile savings and loan products can therefore increase women's decision making power, and financial independence, while also driving more inclusive services in sectors such as sanitation.

Urban areas also offer important competitive and commercial opportunities to mobile operators, which are developing products that simultaneously drive mobile use among women, while also tackling social challenges. In India, Vodafone Idea Ltd launched Sakhi, a service that addresses key barriers women face in access and using mobile technology. It also confronts women's concerns about personal safety, both with regards to threats that arise from owning a mobile phone and general safety concerns that women experience that mobile technology could help address. The service has three features: emergency alert, emergency balance and private recharge.

To find out more, visit the GSMA Connected Women programme webpage, which works with mobile operators and their partners to address the barriers to women accessing and using mobile internet and mobile money services.

Technology as an enabler of inclusion: improving access for people with disabilities

More than one billion people are estimated to live with some form of disability,[108] the majority of whom live in low- or middle-income countries. According to the World Bank, persons with disabilities are more likely to experience socio-economic disadvantage and exclusion than non-disabled persons, especially in healthcare, education and the labour market.

Assistive technologies can support persons with disabilities to overcome the barriers created by this exclusion. The United Nations Convention of the Rights of Person with Disabilities, which counts 181 ratifications, makes the commitment to integrating people with disabilities into society legally binding, and assistive technology represents a key step in removing the barriers to social and economic inclusion. Assistive technologies are products that maintain or improve an individual's functioning and independence, such as wheelchairs or hearing aids, thereby supporting their well-being.[109] However, only 10 per cent of those who need an assistive technology have access to it.

There is a growing concern that the new standard of services being 'digital by default' is not being made accessible, suitable or affordable for those with disabilities.[110] This makes it critical to help understand mobile ownership and mobile usage by persons with disabilities across multiple contexts. A recent report released by the GSMA Assistive Tech Programme found that in Kenya and Bangladesh, persons with disabilities have relatively high ownership of mobile phones, with 83 and 62 per cent ownership respectively, which 'only' represents a 10 per cent gap vis-à-vis non-disabled persons.

There is tremendous potential to leverage mobile ownership among persons with disabilities to reduce inequalities in access to other basic services such as education, transport or financial services. Only 30 per cent of Kenyans with disabilities claim to have full access to transportation, and 13 per cent to education. The main barriers for persons with disabilities to access basic services are additional costs incurred to access services, and their disability, as they face stigma/discrimination from family members, service providers or other basic service users. In addition, most services are not accessible to persons with disabilities as infrastructure and services are not designed inclusively. In both Kenya and Bangladesh persons with disabilities claim that mobile phones help them to access basic services. The extent varies according to country context, the specific disability of the mobile user and the type of basic service under consideration. For instance, 72 per cent of Kenyans with a difficulty remembering/concentrating report being "helped very much" by mobile phones to access transport service, while 25 per cent of Bangladeshis with a difficulty seeing report being "helped very much" by mobile phones to access education services. Overall, at least a third of persons with disabilities in Kenya claim that mobile technology is helping them to access basic services.

The challenge lies in increasing the proportion of persons with disabilities that use these accessibility features (such as screen readers, magnifiers and voice command) on their mobile phone. In Kenya and Bangladesh, only 10 per cent used these features. This limits the perceived value of mobile phones as assistive technologies, and limits the capacity of persons with disabilities to use mobile phones autonomously. Since accessibility features are almost exclusively featured on smartphones, it is critical to make smartphones more accessible to persons with disabilities in emerging markets, and to invest in targeted digital skills training.[111]

By harnessing the synergies between mobile network operators, innovators, and public organisations, the GSMA Assistive Tech programme aims to promote greater access and use of mobile technologies for persons with disabilities and maximise opportunities for social and economic inclusion. One such solution is provided by Turk Telecom, which offers a mobile app called "Loud Steps" to help people with hearing or visual impairments navigate their way around airports, university campuses or shopping centres. In Latin America, Claro in Chile and Entel in Peru provide sign language interpretation for customers with hearing impairment.

105. GSMA (2019), *Creating an 'economic ID' for SMEs in Lagos.*
106. GSMA (2019), *Mobile Gender Gap Report 2019.*
107. Gates Foundation (2018), *Gender and the Sanitation Value Chain: A Review of the Evidence*
108. WHO (2011), *World Disability Report.*

109. GWHO (2018), *Assistive Technology.*
110. Goggin (2017), *Theorizing digital divides.*
111. GSMA (2019), *Understanding the Mobile Disability Gap.*

Conclusion

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 on utility service provision. Developing country governments (at both the city and national 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 and Asian 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. As our case studies show, in cities where the vast majority of the urban poor rely on non-sewered sanitation, municipalities will need to partner with private or informal on-site sanitation services, which can complement or precede the arrival of traditional sewers and conventional on-site solutions.

In the sanitation sector and beyond, mobile technology can be a key enabler of multi-stakeholder collaboration, which provides transparency and accountability. Here, 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 certain things that cannot be leapfrogged. Access to safely managed water and sanitation, reliable power supply, proper waste management, and affordable and convenient transport 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 the most 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.

DIGITAL SOLUTIONS FOR THE URBAN POOR

90%

of global urban population growth from now until 2050 will be concentrated in

Africa & Asia.

Much of this growth will be driven by the **expansion of informal settlements**, where the majority of the urban population in least developed countries lives.

Due to a range of challenges associated with the unprecedented pace of urbanisation, many states and municipalities are

struggling to ensure that the urban poor have access to basic services

such as energy, water, sanitation, waste-management, and transport.

Digital solutions are uniquely placed to help address this challenge.

The expansion of mobile connectivity throughout the developing world has enabled an emergence of digital solutions that are making vital **basic services** such as energy, water, sanitation, waste management, and transport, **more accessible and more affordable**.
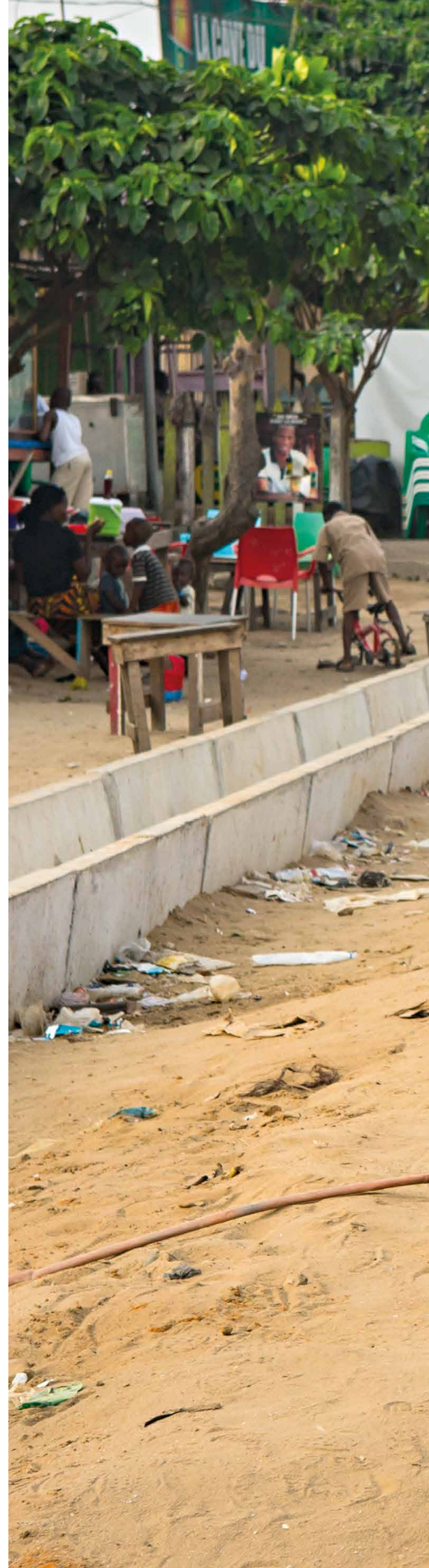
Innovations in basic service provision

succeed when they are tailored to the context in which they are being implemented, unlock social impact, and demonstrate commercial sustainability.

Synergies between mobile operators, start-ups, and municipalities

can form the basis of win-win partnerships that deliver value to all stakeholders.