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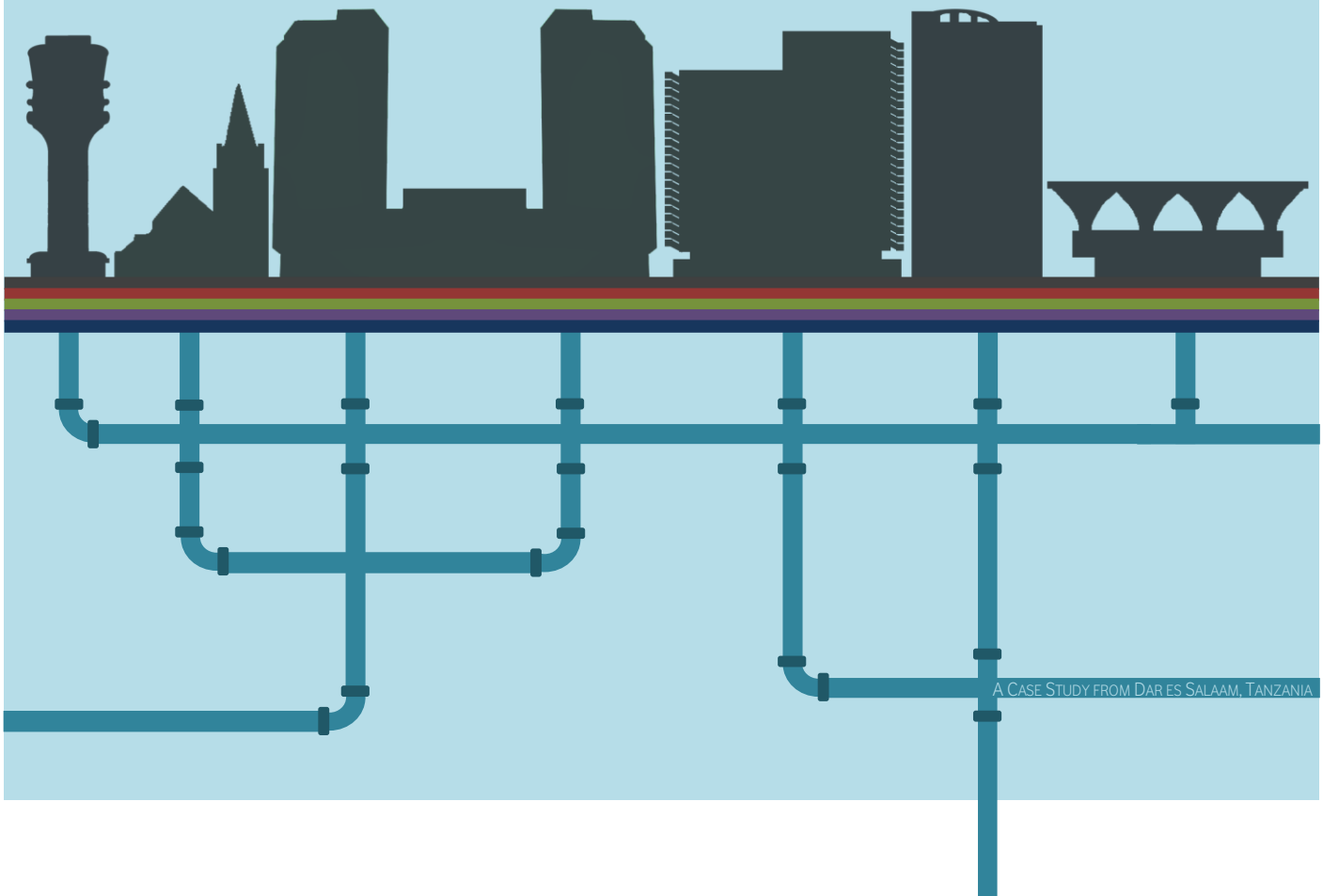
Skoll Centre for Social Entrepreneurship
Saïd Business School

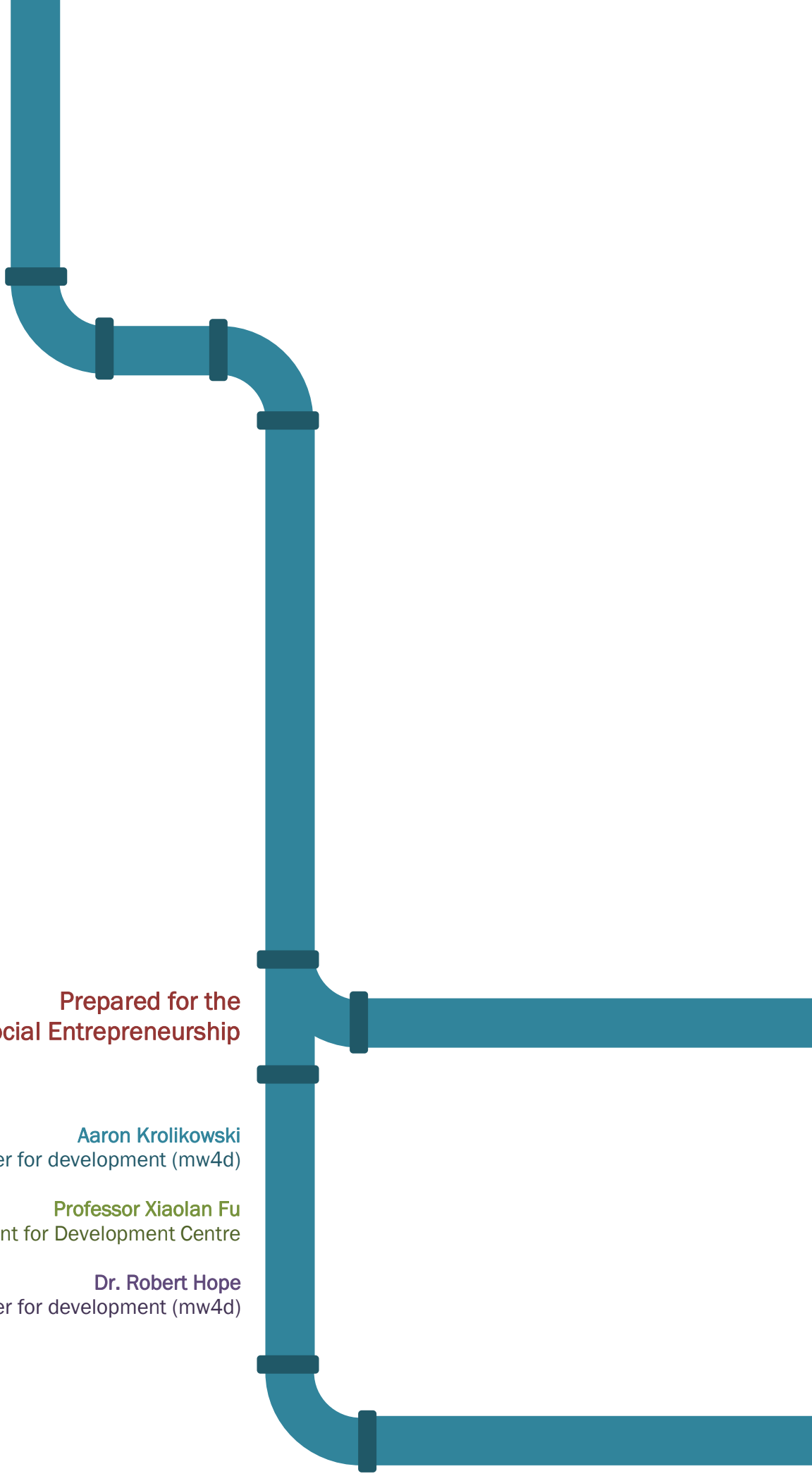
April 2013

Wireless Water:

Improving Urban Water Provision Through Mobile Finance Innovations



A Case Study from Dar es Salaam, Tanzania



Prepared for the
Skoll Centre for Social Entrepreneurship

Aaron Krolikowski
mobile/water for development (mw4d)

Professor Xiaolan Fu
Technology and Management for Development Centre

Dr. Robert Hope
mobile/water for development (mw4d)

Contents

Contacts

General: Aaron Krolikowski
aaron.krolikowski@ouce.ox.ac.uk

TMD Centre: Dr. Xiaolan Fu
xiaolan.fu@qeh.ox.ac.uk
http://www.tmd-oxford.org

mw4d: Dr. Rob Hope
robert.hope@ouce.ox.ac.uk
http://oxwater.co.uk

Skoll Centre: Dr. Pamela Hartigan
pamela.hartigan@sbs.ox.ac.uk
http://www.sbs.ox.ac.uk/centres/skoll

The Research Project

This research project examines the emerging relationships between urban water provision and the growing use of mobile payment innovations in Dar es Salaam – the commercial capital of Tanzania and a centre of innovation for the application of mobile technologies to public service provision.

The Dar es Salaam Water and Sewerage Corporation (DAWASCO) was the first urban water utility in Sub-Saharan Africa to offer mobile-enabled payments for water services. Novel payment solutions include mobile money services, mobile banking channels, and networks of wireless pay points throughout the city. There has been much speculation regarding the impacts of mobile payment systems on customer payment behaviours, water utility performance and efficiency, and access to water services by the urban poor.

This report focuses on the contributions mobile-enabled payment methods have made toward improving water provision via four priority areas of exploration. These include:

i) financial sustainability,
ii) governance and citizen empowerment,
iii) customer choice in household finance, and
iv) engaging target populations.

Among the key findings: mobile payment methods reduce opportunities for petty corruption, improve revenue collection per customer, and enhance the quality of data generated by the billing and payment process.

This research was conducted in partnership with the Dar es Salaam Water and Sewerage Corporation (DAWASCO), the Dar es Salaam Water and Sewerage Authority (DAWASA), Vodacom Tanzania, Airtel Tanzania, and Selcom Wireless. Generous support for this research was provided by the Skoll Centre for Social Entrepreneurship, the Clarendon Fund, and Green Templeton College.

We kindly acknowledge Eng. Jackson Midala (DAWASCO), Mr. Kiula Kingu (DAWASCO), the enumeration team (acknowledged individually within), SNV Tanzania, Twaweza/Uwazi East Africa, and all those in Tanzania and the United Kingdom who supported the completion of this work.

Executive Summary

Mobile phones and networks are being used to bring about change in the water and sanitation, education, health, and agricultural sectors throughout Sub-Saharan Africa. In East Africa, where mobile technologies and related innovations are most prevalent, mobile payment innovations (e.g. M-PESA, Selcom Pay Points, etc.) can improve public service delivery by creating enabling environments for greater transparency, increases in accountability, and removing opportunities for theft, bribery, and collusion.

By addressing the fraudulent activities that commonly obstruct the effective governance and financial management of public utilities, critical mobile innovations can be used to enhance urban water provision in Africa, where chronic poor performance and unsatisfactory service levels are attributed to crises of governance and inadequate financial sustainability in the sector.

Dar es Salaam, Tanzania was chosen as the focus of this study because it faces difficult challenges as it works to provide water services in one of Africa's fastest-growing cities. The water utility began using mobile-enabled payment methods (i.e. mobile money services, mobile banking channels, and wireless pay points) in mid-2009 to augment revenue collection and improve customer services. But what implications do these new payment modalities hold for service quality, wider access, and the financial sustainability of water service providers? By using innovative payment methods, the water utility in Dar es Salaam may be leading Sub-Saharan Africa into a new era of urban water provision.

This report surveys the findings of a project funded by the Skoll Centre for Social Entrepreneurship that aims to understand the emerging relationships between new payment mechanisms and development outcomes, with a specific focus on urban water provision in East Africa. Payment options, particularly those built on now-widespread mobile network infrastructures, are becoming ubiquitous in Sub-Saharan Africa and around the world. The crowded nature of this space will inevitably generate confusion regarding the 'best' payment methods; this research hopes to support greater knowledge and informed decision-making in this area.

Evidence for the report was gained through analysis of a large payment database, semi-structured interviews with individuals and groups involved in new payment channels, and a customer payment preference survey that generated over 1000 responses. The report's recommendations are intended to help governments, public service providers, and entrepreneurs understand the potential implications of using mobile-enabled payment methods to improve quality of life for the billions of people that still lack access to even basic goods and services.

Four supplementary documents accompany this report: three analytical summaries covering customer payment behaviours, user characteristics, and governance; and a two-page policy brief aimed at policy makers. Each document contains background information, key information, and recommendations related to the use of mobile-enabled payment methods in public service delivery.

All public outputs will be available on the mobile/water for development website: www.oxwater.co.uk

Introduction: Leaky Pipes in a Wireless World

Urban water providers across Africa face daunting challenges as

Urbanization
Population Growth
Inadequate Financing
Unplanned Settlements
Poor Governance/Corruption

Prevent the effective provision of water services in many African cities.

Crises of Urban Water Provision

What is the state of urban water provision in Africa? Some numbers...

Over
330,000,000
people in Africa still lack access to
improved water sources

Only
19
out of
50
countries are on track to meet the MDG drinking water target by 2015

In 2010, only
26%
of urban water users were connected to piped supplies, down from
50%
in 1990.

Urban water utilities can lose up to
70%
of water supplies through leaky pipes, theft, and corruption

Ineffective billing and payment collection accounts for an annual loss of
500,000,000 USD

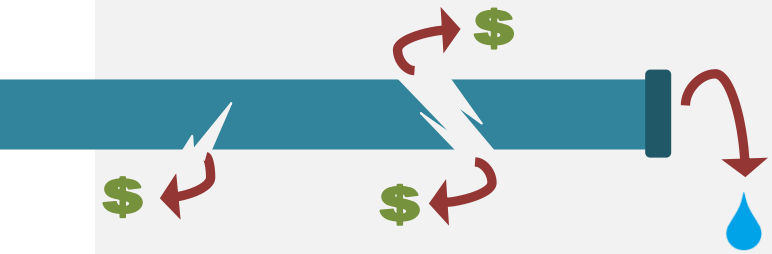
Combinations of poor operational performance and insufficient cost-recovery traps urban water service providers in spirals of decline that they have been struggling to get out of. Experts in the water sector have suggested that **poor billing and payment systems**, **corruption**, **distributional losses**, and **overstaffing** are to blame for crises of urban water provision. Mobile-enabled payment systems can help to overcome these barriers and foster the effective delivery of water services.

Expansion of Mobile Technologies and Payment Innovations

Mobile telephony and related innovations are most prevalent in East Africa (i.e. Kenya, Tanzania, Uganda), and most households have access to a mobile phone. Daily life is rapidly changing as more people are able to improve their ability to obtain information and expand their communication with others.

Mobile subscriptions in Africa are expected to reach over 700 million people by 2016. Today, penetration rates are 69% in Kenya, 50% in Tanzania, and 42% in Uganda. This translates into over 61 million mobile users in a region that counted less than 1 million fixed line connections just ten years ago.

Mobile phones are being used to improve household and social coordination, supply chain management, small and medium-size business development, disease prevention and management, and agricultural extension services. Incorporating mobile technologies into the public water sector can help stem the outflow of revenues and reverse spirals of decline.

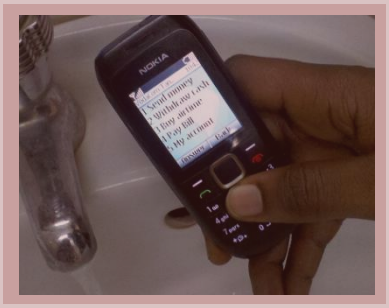


Like a leaky pipe, cash-based payment pathways lose a significant amount of the resource (payments) as it travels through the channel.

One such technological application is the use of mobile technologies for personal and household financial management. Mobile money services are now commonplace in East Africa. Individuals and households are accessing basic financial services – deposits, withdrawals, transfers, and storage. These services were popularized through their use for domestic remittances in Kenya, but now they are used for a range of payments for goods and services, including bill payments.

Mobile-enabled payment methods include:

Mobile Money



Handset-based

Electronic cash is transferred electronically

Reliance on agent networks

Mobile Banking

Handset-based

Funds linked to bank account are transferred electronically

Reliance on bank branches

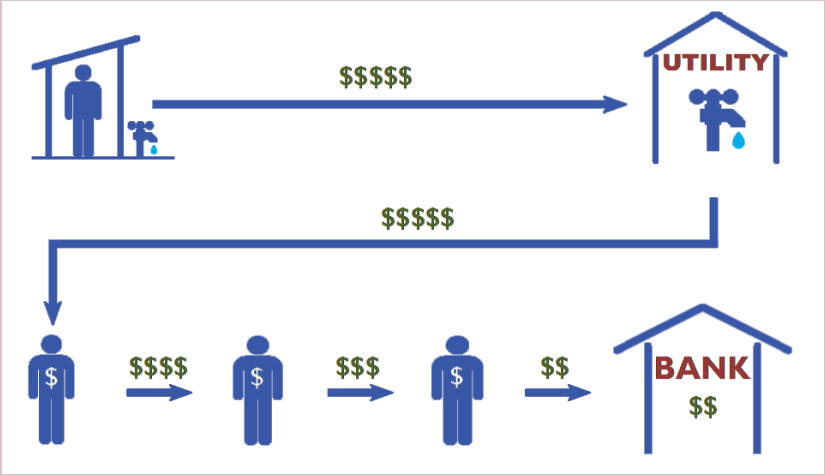
Wireless Pay Points

Point-of-sale device communicates over mobile networks

Physical cash payments that are transferred electronically

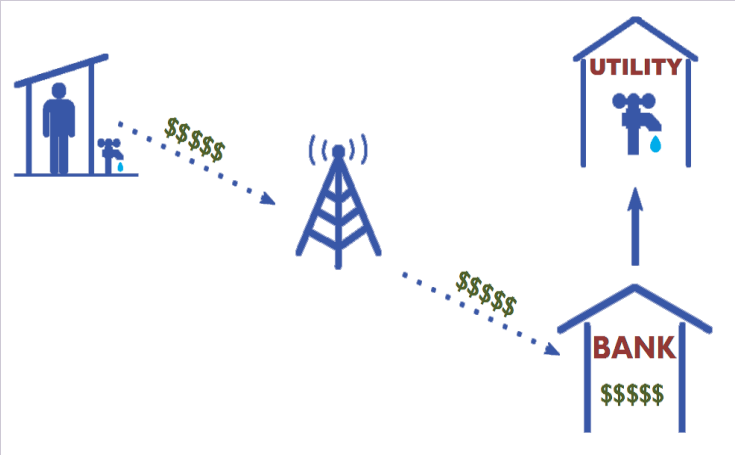
Physical locations

Paying Your Bill – Traditional and Mobile-Enabled Methods



Traditional payment methods (e.g. water offices) usually include relatively high travel costs and long queues. In Dar es Salaam, there are 14 water offices that are only open 45 hours/week. When someone pays a bill at the water office, money can sometimes 'fall off the table.'

Mobile-enabled payment methods (e.g. mobile money, wireless pay points) usually include little to no travel, minimal costs, and a quick transaction. In Dar es Salaam, there are over 2000 wireless pay points that are open more than 100 hours/week. Customers paying with mobile money can make a payment at any time and from anywhere. When someone pays a bill using these methods, money travels electronically and the risk of theft is negligible.



By trying to understand new payment methods and how they can assist in development strategies, three questions have emerged:

What factors influence customer decisions to pay for water services using mobile-enabled methods?

How can these methods be used to support increases in transparency, accountability, and responsiveness in public services delivery?

Is evidence of payment method preference in the urban water sector applicable to and relevant for other sectors, including micro-finance and financial inclusion, health, education, and the provision of other public services?

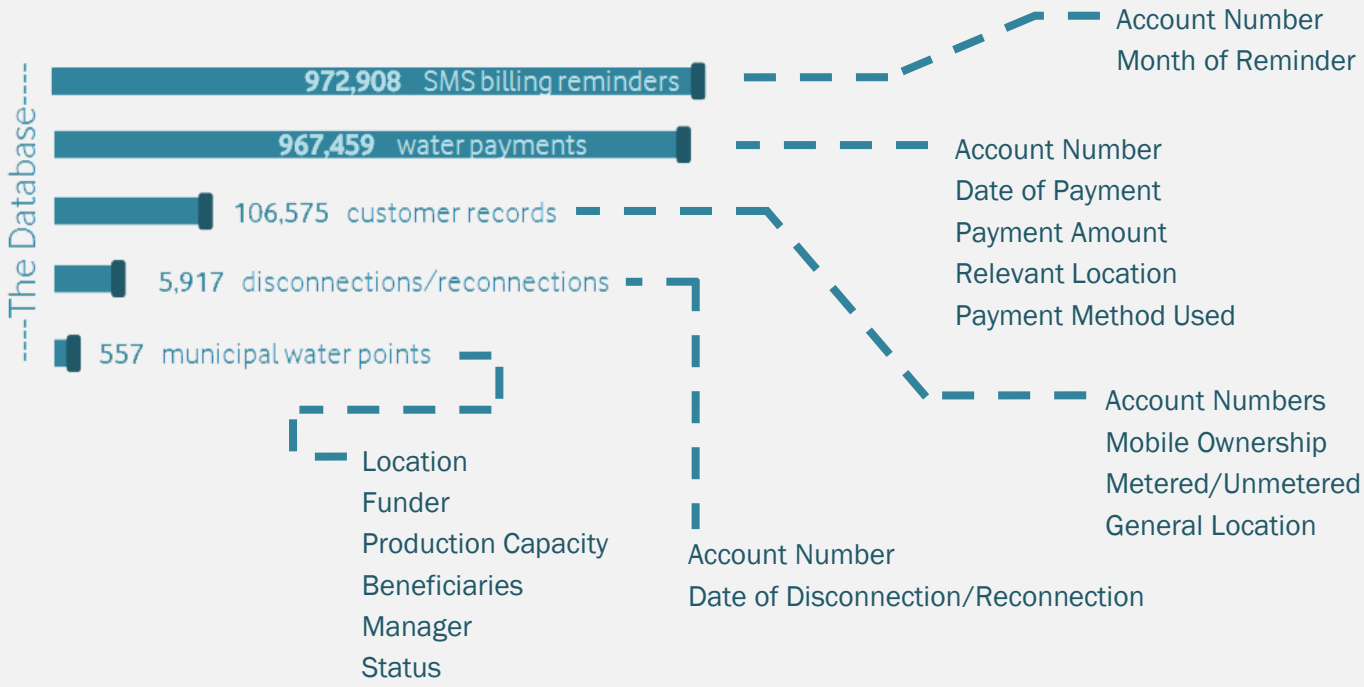
Methods and Data Collection

Three types of data were collected:

- 24-month database of water payments
- Large-scale customer survey on payment preferences (n=1097)
- Semi-structured interviews with key water sector actors and officials (n=42)

Payment Database

The database contains information on payments that were made between **1 January 2010** and **31 December 2011**.



Water User Survey

The survey was administered over five weeks at over 40 physical locations throughout Dar es Salaam. Water utility customers were invited to take part in the survey and **a total of 1097 responses were generated**.

Responses include information related to:

- Geographic Location and Housing
- Demographics
- Socioeconomics
- Assets/Expenditures
- Mobile Phone Use
- Water Use
- Payment Methods and Preferences
- Service Satisfaction
- Disconnections/Reconnections
- Alternative Water Sources
- Community Supplying Behaviours
- SMS Billing Reminders
- Payment Behaviours

Interviews

Semi-structured interviews were carried out with multiple actors in the water sector to provide context to the billing and payment processes. **42 interviews were conducted** with individuals and groups relevant to the design, implementation, and impacts of mobile-enabled payment methods.

Interviews took place with representatives from:

- Water Utility (12)
- Mobile Network Operators (6)
- Ministry of Water (4)
- Banks (3)
- Municipal Water Officers (3)
- Third Party Companies (3)
- Regulatory Authority (2)
- Water Authority (2)
- Civil Society (2)
- Water Committees (2)

Research Team

The surveys were administered during **August and September 2012** by a team of six research assistants. These six individuals include:

Benson — Benson studied Information Technology at the Institute of Finance Management and has experience with the use of mobile technology to facilitate project administration. He is currently an instructor in IT courses at the Open University of Tanzania.

Itala — Itala has a Bachelor's degree in Geography from the University of Dar es Salaam and has competencies in survey administration and other research methodologies. His research interests are focused on poverty and access to environmental resources.

Jennifer — Jennifer is a graduate of Saint Augustine University of Tanzania in Mwanza and earned a degree in Communications. She has experience working with the National Housing Corporation, the National Health Insurance Fund, and Twaweza.

Mary — Mary completed a masters degree in graduate-level Economics at the University of Dar es Salaam. She has worked for the National Bank of Commerce, the Ministry of Finance and Economic Affairs, and CARE International.

Sarah — Sarah graduated from Tumaini University in Iringa and earned a degree in Cultural Anthropology and Tourism. She has extensive experience in project management and monitoring as a result of her work with the Foundation for Civil Society.

Wilhelm — Wilhelm studied software engineering and MIS. He founded a learning lab in Dar es Salaam aimed at enhancing the IT skills of area youth. Willy is working on a project using mobile technology in educational supply chain management.

Priority Findings

These comprehensive datasets provide the first in-depth examination of mobile-enabled payments for public service delivery.

The evidence and related analyses for the findings presented here will be shared in forthcoming academic publications to provide the empirical backing for the findings summarised below.

Highlights of the research project are discussed below across four key areas:

i) financial sustainability,
ii) governance and citizen empowerment,
iii) customer choice in household finance, and
iv) engaging target populations.

Financial Sustainability

Water providers often struggle to collect sufficient revenues to cover their monthly and annual costs of service provision. Revenues are lost indirectly through the loss of water resources through ageing infrastructures or via human-related losses such as illegal connections and collusive water theft. Funds can be siphoned from the billing and payment process in the form of extra-legal payments for water services (e.g. connection fees, prevention of disconnection) and through large-scale or petty theft of cash payments that are made to utility employees or at an area water office.

Mobile payment innovations can be an effective tool for improvements in revenue collection and controlling governance-related losses.

Key Findings:

*Mobile payment methods **contribute to greater annual revenue collection** per customer.

*Customers who **combined payment methods** (i.e. traditional *and* mobile-enabled) increased the annual revenue collection of the utility.

*Customers using mobile-enabled methods made **more payments per year**.

*Mobile payment innovations **did not improve payment timeliness** in Dar es Salaam.

Key Recommendations:

*Water utilities and other public service providers should **raise customer awareness** that mobile payment methods exist.

*Governments and service providers should encourage and **facilitate the establishment of mobile-enabled payment services**.

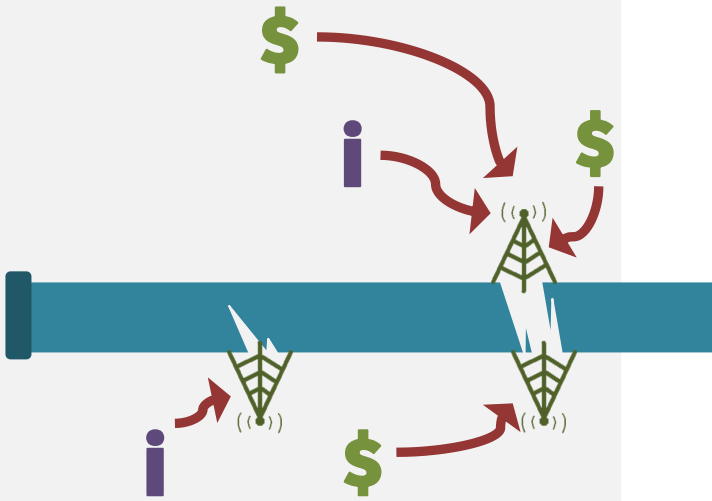
*Public service providers **should not rely on mobile-enabled methods to improve monthly cash flows**, but can be optimistic about their impacts on annual financial sustainability.

Governance and Citizen Empowerment

Investing in the urban water sector is often viewed as a poor choice due to widespread perceptions of corruption and a lack of transparency. Corruption-related activities simultaneously decrease the efficiency of ongoing investments and reduce the effectiveness of existing infrastructures and programmes. As a consequence, large amounts of money can be lost in infrastructure projects and the overall impacts of water-related investments are minimised. On the ground, petty corruption and other forms of illegal activity can hinder the effective provision of water services.

Mobile-enabled payment methods offer citizens new types of choice in payment options and empower them to passively fight corruption and improve the transparency of the water sector simply through the payment method they use.

If traditional payment methods are like leaky pipes, then mobile-enabled payment options use mobile networks and technologies to 'patch up' those leaks. Mobile methods create payment channels are that more fully closed. This prevents the loss of revenues and enables more information and financial resources to enter the system and improve water provision.



Key Findings:

*Mobile payment innovations **generate reliable data** that enhance the transparency of the sector.

*Mobile-enabled payments **remove opportunities for petty corruption** by reducing the amount of cash that moves through payment channels.

*Mobile technologies give citizens the **power to hold service providers accountable**.

Key Recommendations:

*Public service providers should make efforts to **educate their employees** on the operations of these new methods.

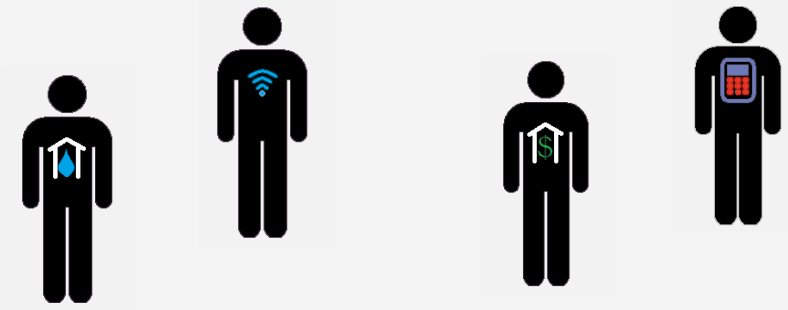
*Water service providers can use reliable data generated by mobile-enabled payment methods to **support higher-quality decision-making**.

*Customers should be educated on the impacts their payment choices can have on the quality of water service delivery.

Payment Behaviours and Household Finance

Many customers face structural barriers to accessing directly-provided water services due to irregular incomes and under-the-mattress storage of money. As a result, a large number of citizens cannot make monthly payments. Illegal tenure, unplanned neighbourhood layouts, and income constraints also prevent urban populations from receiving piped water supplies. The challenges imposed by a monthly billing and payment paradigm are significant enough to prevent lower-income customers from accessing these water services. Prohibitive connection fees and monthly balances require citizens to have the ability to save for bills, something most households cannot do when they are living on sub-monthly income cycles.

The goal is to identify new mechanisms of payment in which these customers can access official water provision systems while preventing the creation of new opportunities for rent-seeking.



Key Findings:

*Mobile payment innovations **break down the monthly billing and payment paradigm** by allowing households to pay when, where, and how they want.

*Customers using mobile-enabled payment methods were **more likely to make multiple payments** each month.

*Many customers reported having to **save each month to pay their water bill**.

*Mobile methods facilitate **closer interactions between payment behaviours and income patterns**.

Key Recommendations:

*Water utilities or public service providers should **develop long-term payment plans** to enable low-income households to more easily access new water connections.

*There should be greater support for customer payment practices that involve **splitting monthly bills into multiple payments**.

Engaging Target Populations

Until recently, water utility customers were faceless entities – characterised and stereotyped as wealthy, educated, and geographically segregated from the rest of the population. It mattered less what kinds of customers were paying their bills because it was assumed that they were relatively similar with only one real option for paying for water – area water offices. A new era of payment options opens the door to understanding which individuals and groups are more likely to engage different modes of payment.

Contrary to conventional wisdom, water utility customers are actually socioeconomically, geographically, and demographically diverse.

Key Findings:

*Lower-income customers were more likely to use wireless pay points.

*Mobile money payers tended to be wealthier and well-educated.

*Users of mobile-enabled payment methods are more likely to share water with their neighbours.

*Customers are more likely to use a payment option that is nearby.

Key Recommendations:

*Public service providers should effectively engage customers by gathering data to improve service delivery.

*Public service providers should develop SMS-based campaigns to encourage customers to use key payment methods that are most likely to complement their quality of life.

*Mobile technologies enable a greater degree of automatic information sharing from the utility to the customer and should be used to share information on service outages, payment options, and water-related emergencies.

Discussion: Patching Leaky Pipes

Mobile payment innovations are being used to improve revenues, reduce corruption, and enhance customer services.

Information is more accessible than ever before

Accurate records are being generated on a daily basis

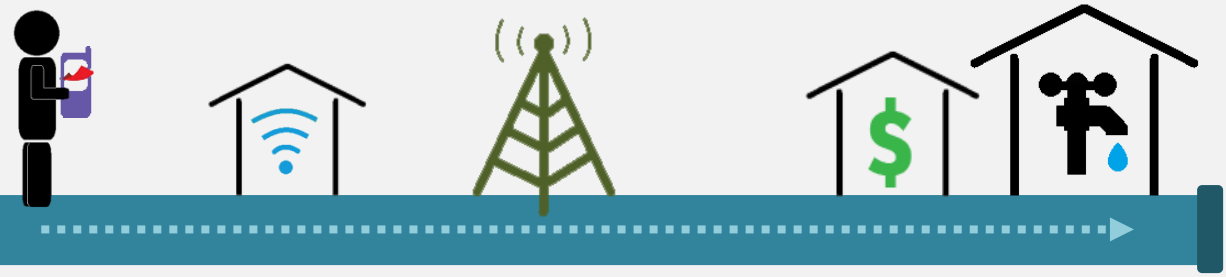
Human errors and exploitation in payment processes are declining

But can these positive impacts be leveraged for
overall improvements in service delivery and access?

Influencing Customer Choice

Ideally, customers would discretely sort themselves by payment method and straightforward comparisons could be made between those using wireless pay points, water offices, banks, and mobile money. In reality, customers tend to use combinations of payment methods, most likely to suit their needs and specific context at the time of payment.

Customers tended to value distance to the payment location, appreciate the availability of multiple services from a specific method, and expressed distaste for long queues and waiting. Customers who chose not to use specific methods made the decision largely on the basis of distance, waiting time, and awareness of options.



Customers will choose the closest, quickest, and most trustworthy payment option. If it is a new method, customer must be exposed to the new technology and it must match some need in their lives.

Providers of payment services should:

1) Offer a payment method

2) Educate consumers on how to use it

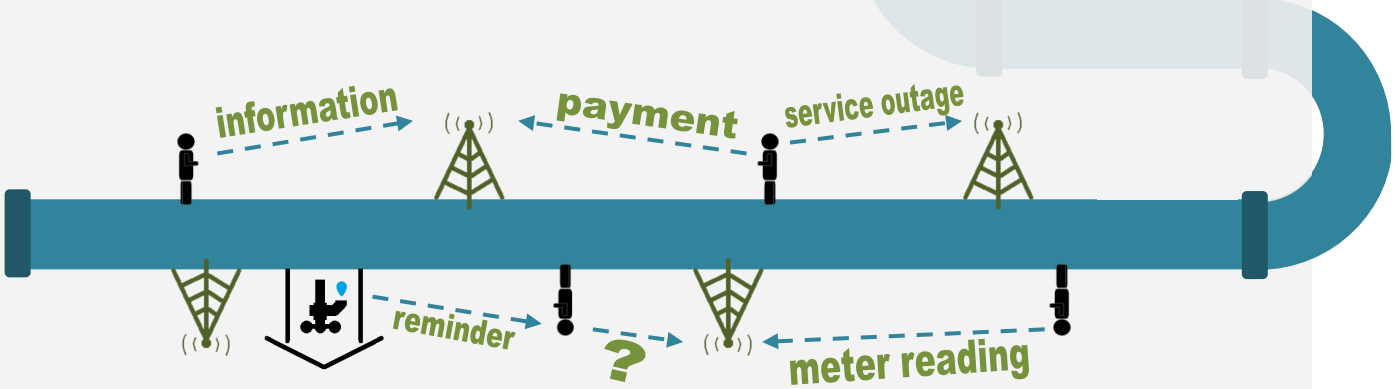
3) Connect customers to the goods and services they can pay for

Mitigating Institutional Resistance

The disruptive nature of mobile payment solutions has generated institutional resistance - ground-level employees are less likely to be receptive to these novel methods and are particularly critical of mobile money payments.

Resistance to the changes often occurs where the potential for opportunistic petty corruption is threatened – such as meter readings, disconnection exercises, and cash payments at water offices. Mitigating this resistance must take a multi-faceted approach that enables, rather than punishes, those who previously enjoyed extra-legal benefits from traditional billing and payment processes. For example, if field agents use wireless pay points to collect payments in the field, they might be able to collect a percentage of each bill collected and work effectively to improve, even further, cost recovery for the utility.

Encouraging participation in the payment process, alongside customers, is perhaps the most effective and educational way to increase familiarity with, and acceptance of, mobile-enabled payment methods.



Applicability to Other Sectors

A wide variety of entities are currently using these payment systems in Tanzania, including electricity providers, healthcare institutions, examination boards, revenue authorities, tourism agencies, microfinance institutions, and many others.

The national power provider in Tanzania has been the most effective at incorporating mobile-enabled payment methods due to their ability to have pre-paid electricity meters that remove interactions with the electricity utility almost completely from the lives of customers. It is appropriate to use these payment mechanisms in other sectors, but we suggest that careful attention must be paid to the context in which the payment innovation is going to be deployed. The intervention must match an existing need and sincere efforts at educating consumers on the payment option must be made.

Paying attention to context, ensuring that the utility or other entity is sincere about its motivations for using new methods, and a focus on the citizen are the major ingredients necessary to improve adoption of mobile-enabled payment methods and facilitate the emergence of the many benefits they can bring, particularly for public service provision.

Conclusions and Future Directions

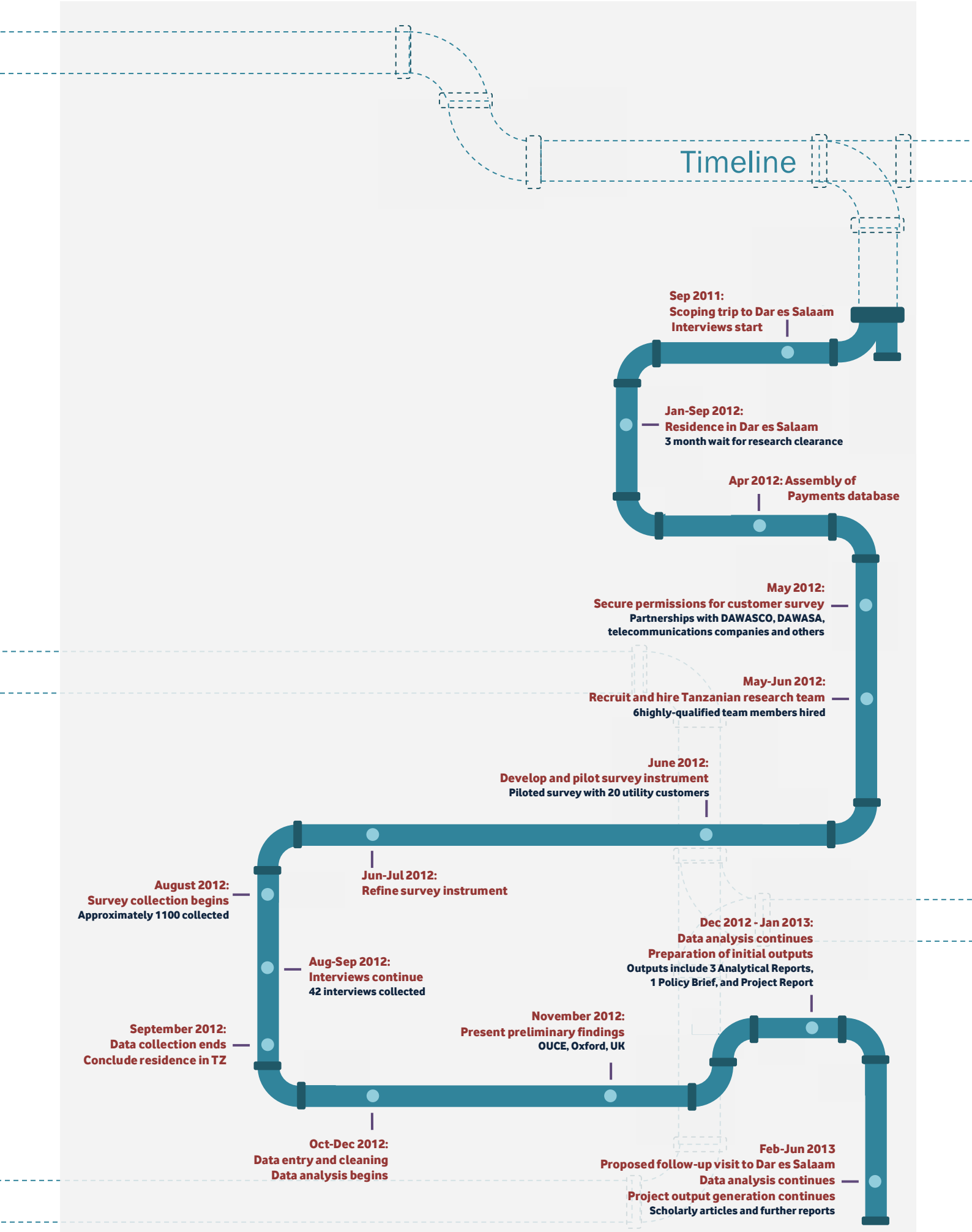
Mobile payment solutions are improving urban water provision in Dar es Salaam, Tanzania and can potentially do the same across Sub-Saharan Africa.

Life in East Africa has been punctuated by the introduction of mobile technologies, but improvements in service delivery are gradual – the urban water sector is being subtly realigned as electronic payment methods are adopted over time. By indirectly restructuring power and implicitly modifying information flows, crises of urban water provision are declining as opportunities for corruption-related activities are progressively removed and gains in the financial sustainability of the sector are supported.

The evolution of public service delivery as a function of the introduction of mobile technologies is entering a dynamic and exciting phase of innovation never before seen on the African continent.

New approaches to financing not only public services, but life in general, are emerging out of a globally unique context of necessity, limited resources, expansive communication capabilities, and increasing human capital. The road ahead is relatively unpredictable and the scale of the 'mobile revolution' makes it almost impossible for any single perspective to be completely accurate or comprehensive. The limited, almost nonexistent, research on this major transformation of Africa's numerous societies suggests that a greater number of observers, perspectives, and interpretations are necessary to truly understand the monumental changes that are currently taking place.

Timeline


Sep 2011:
Scoping trip to Dar es Salaam
Interviews start
Jan-Sep 2012:
Residence in Dar es Salaam
3 month wait for research clearance
Apr 2012: Assembly of
Payments database
May 2012:
Secure permissions for customer survey
Partnerships with DAWASCO, DAWASA,
telecommunications companies and others
May-Jun 2012:
Recruit and hire Tanzanian research team
6highly-qualified team members hired
June 2012:
Develop and pilot survey instrument
Piloted survey with 20 utility customers
Jun-Jul 2012:
Refine survey instrument
August 2012:
Survey collection begins
Approximately 1100 collected
Aug-Sep 2012:
Interviews continue
42 interviews collected
September 2012:
Data collection ends
Conclude residence in TZ
Oct-Dec 2012:
Data entry and cleaning
Data analysis begins
November 2012:
Present preliminary findings
OUCE, Oxford, UK
Dec 2012 - Jan 2013:
Data analysis continues
Preparation of initial outputs
Outputs include 3 Analytical Reports,
1 Policy Brief, and Project Report
Feb-Jun 2013
Proposed follow-up visit to Dar es Salaam
Data analysis continues
Project output generation continues
Scholarly articles and further reports

Related Documents

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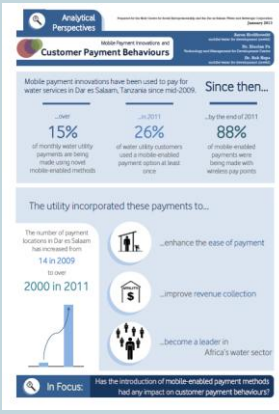

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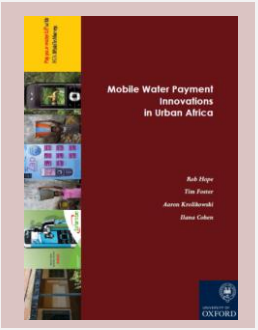

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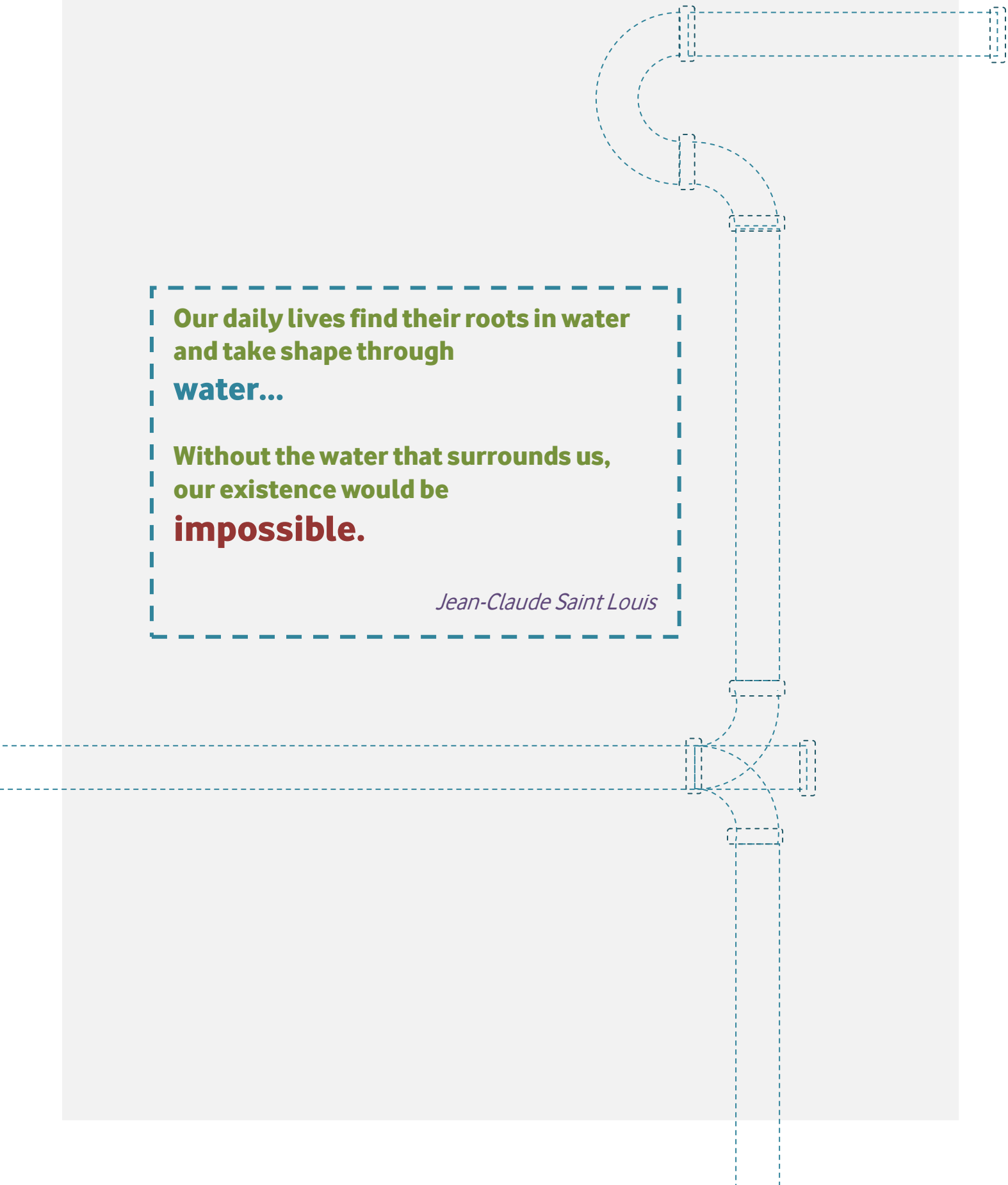
Our daily lives find their roots in water and take shape through

water...

Without the water that surrounds us, our existence would be

impossible.

Jean-Claude Saint Louis



mobile/water for development (mw4d)
School of Geography and the Environment
University of Oxford
Oxford OX1 3QY
+44(0)1865 285070

Technology and Management for Development Centre
Department of International Development
University of Oxford
Oxford OX1 3TB
+44(0)1865 281800

Skoll Centre for Social Entrepreneurship
Saïd Business School
University of Oxford
Oxford OX1 1HP
+44(0)1865 422800