Key trends in mobile-enabled water services:

What's working and what's next

Author: Akanksha Sharma, Senior Insights Manager, GSMA Mobile for Development Utilities

Cover: image courtesy CityTaps

GSMA Mobile for Development Utilities

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For more information, please contact us:
Web: www.gsma.com/m4dutilities
Email: M4DUtilities@gsma.com

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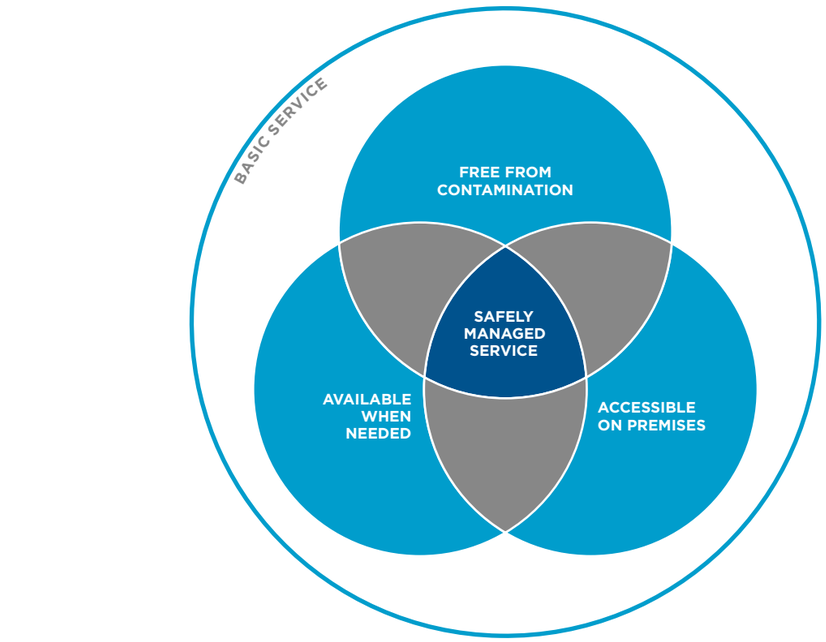
1. Access to safe drinking water: The goal post has moved

The latest revision to the WHO/UNICEF WASH monitoring framework has broadened the scope from simply accounting for access to improved sources of drinking water, to ensuring that drinking water is available on premises, when needed and free of faecal and locally occurring chemical contaminants.[1] This definition has shone light on a much bigger gap in safe water access and the urgent need to accelerate efforts to bridge this gap and achieve Sustainable Development Goal (SDG) 6. Today, 844 million people still lack even basic drinking water service, and 2.1 billion people lack access to safely managed water. The situation is much worse in rural areas where only 55 per cent of the population has access to safely managed water compared to 85 per cent in urban areas.

1. SDG 6: Clean Water and Sanitation: http://datatopics.worldbank.org/sdgatlas/SDG-06-clean-water-and-sanitation.html

FIGURE 1 Source: World Health Organisation (WHO)

Revised JMP ladders for drinking water



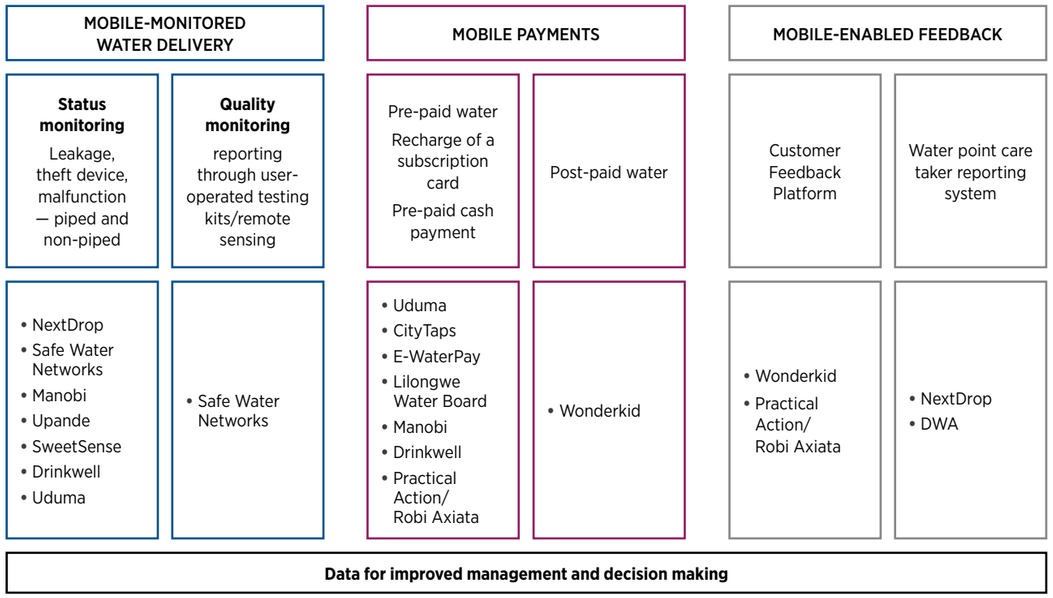
SERVICE LEVEL	DEFINITION
SAFELY MANAGED	Drinking water from an improved water source that is located on premises, available when needed and free from faecal and priority chemical contamination
BASIC	Drinking water from an improved source, provided collection time is not more than 30 minutes for a round trip, including queuing
LIMITED	Drinking water from an improved source for which collection time exceeds 30 minutes for a round trip, including queuing
UNIMPROVED	Drinking water from an unprotected dug well or unprotected spring
SURFACE WATER	Drinking water directly from a river, dam, lake, pond, stream, canal or irrigation canal

Note: Improved sources include: pipped water, boreholes or tubewells, protected dug wells, protected springs, rainwater, and packaged or delivered water.

However, a vast number of individuals who do not have access to water are covered by mobile networks, and constitute a large addressable market for whom mobile-enabled water solutions could make a real difference. There are roughly 373 million people across the globe covered by 2G/3G networks who do not have access to basic water services,[2] although this number underestimates the real addressable market: those who are covered by mobile networks but face water-related challenges, such as an unreliable water supply, inefficient payment channels and unclear/irregular billing cycles, broken water points and poor customer service/complaint management systems. All these issues could be improved with the use of mobile services.

FIGURE 2 Source: GSMA M4D Utilities

Use cases for mobile-enabled water delivery (categories may overlap)



2. Note: The addressable market was calculated based on those without access to water living within 2G or 3G mobile network coverage (coverage data as per GSMA Intelligence estimates). The WHO definition of "improved drinking water sources" includes sources that, by nature of their construction or through active intervention, are protected from outside contamination, particularly faecal matter. This includes piped water in a dwelling, plot or yard, and other improved water sources.

2. Three trends in mobile-enabled water delivery

In partnership with the UK Department for International Development (DFID), the GSMA M4D Utilities programme has provided funding to 50 organisations across four continents since 2013. Of these, 14 grants have been awarded to organisations trialling mobile-enabled solutions that facilitate delivery and payments for water services. Over the last five years, we have seen many business models in water services evolve and mature, and others struggle.

In this report, we have identified three key trends in mobile-enabled water delivery that have been tested in a range of countries and have potential to scale. We explore these in light of broader industry trends, as well as in-depth lessons collected from our grants and one-to-one interviews with entrepreneurs in the water sector.

a. Pay-as-you-go water is picking up, but mobile money still needs a push

It is not surprising that pay-as-you-go (PAYG) water, or pre-paid water, is helping to break down affordability barriers in the water sector, particularly in combination with mobile payments. For low-income customers, it is easier to pay for what they consume in smaller amounts rather than a lump sum at the end of a billing cycle, especially for a service that may not necessarily have provided a steady, timely and safe supply of water. Using mobile payments also saves customers time and money by providing a secure channel to pay for water at a fair and set price without the need to travel to a local utility office.

For service providers, mobile payments enable regular revenue collection, lower administrative costs (usually by eliminating cash handling expenses), reduce the number of human errors associated with traditional payment methods and remove the risks of handling and keeping cash safe until it is deposited in the bank. For providers to reinvest in maintenance and expand

their services to reach the underserved, it is essential to recover more water delivery revenue.

Community water points are often considered a stop-gap solution to safe and affordable piped water to households. However, geographical, operational and financial constraints to expanding piped infrastructure, particularly in rural areas or informal settlements, mean that community water points will remain an essential part of the water mix for the foreseeable future. They are therefore an important use case for PAYG water as they provide a modular and decentralised way to deliver safely treated drinking water. Prepayment at communal water points can either be automated using machine-to-machine (M2M) connectivity that allows customers to top up their accounts using mobile money, or through other means when water systems are not automated. For example, water payments at hand pumps can still be digitised to ensure accountability and transparency.

Grundfos Lifelink in Kenya[3] and Sarvajal in India have been offering pre-paid water services for close to 10 years.[4] One of our grantees, eWaterPay,[5] has designed eWATERtaps that can be operated using an RFID tag on a tap reader. Credit is added either when a customer pays an agent cash, who then uses a smartphone app with NFC to top up their balance, or when they pay independently using mobile money and their account credit is updated when the tag is tapped on the device.[6] The grant demonstrated that pre-payments resulted in 100% payment collection for eWATERtaps, as end users paid for all the water they received.

Meanwhile, Drinkwell in Bangladesh is partnering with Dhaka Water Supply & Sewerage Authority (DWASA) and mobile operator Robi Axiata to operate water ATMs in Dhaka fitted with smart meters. Customers can use mobile payments to purchase water, while ATM caretakers transfer the funds to DWASA.

Although **payments for piped water in households** are often paid at the end of a billing cycle, CityTaps has developed the 'CTSuite solution', a smart prepaid mobile money (LoRaWAN) water meter that lets subscribers pay for household water as they consume it (PAYG). The suite also allows the utility to manage the smaller, more frequent advance payments through a subscriber management dashboard.

In an initial pilot in 2015 with the Niger water utility Société d'Exploitation des Eaux du Niger (SEEN) and Orange, CityTaps deployed 20 CTMeters to serve 261 individuals and saw a bump in mobile money adoption among water customers. Seventy-two per cent of users opened mobile money accounts for the first time and nearly 90 per cent indicated that they preferred to pay with mobile money. The prepaid service was popular due to its flexible payment schedules and 16 percent cheaper water than piped water. Under the current M4D Utilities grant, CityTaps is planning to add over 1,000 meters and, through its partnership with Orange Fab, hopes to expand its geographical presence in more West African countries.

Still, **mobile payments in the water sector have been very slow to pick up**. In markets where mobile money is less mature and customers are less familiar with the concept of mobile money, new digital interfaces are a big challenge, particularly complex user interfaces. In this case, a strong network of well-trained agents can be key to scaling utility payments business models. Time and effort is required to train these agents, however, as well as create incentives for them to teach customers how to operate their accounts independently. Over-the-counter (OTC) payments have worked well for energy payments in countries where awareness of mobile money is low and could also be a way to encourage digitisation of water payments, but there is much more value in enabling water customers to transact independently (rather than relying on a third party to pay on their behalf) since the need and ready availability of water is much more immediate than for electricity.

One of our grantees, Manobi,[7] has developed a digital management platform for Water Piped Systems operators to log operational data from their rural micro-water utility networks. In partnership with MTN and Moov Benin, they have developed new functionalities for their existing mWater mobile app and platform to enable mobile water bill payment and profit and loss (P&L) reporting. However, they encountered several challenges over the course of the grant. They found that late receipt of payment confirmation after completing a transaction created trust issues among new mobile money users. A sometimes unreliable water supply from the service provider also added to the difficulty and prevented customers from embracing the mobile money aspect of the business model.[8]

Water is a human right, and historically governments have attempted to provide free water services. However, this has led to unsustainable services, a wide access gap and consumer resistance to paying for water, especially when alternative, although unsafe, water sources are readily available. It is therefore difficult to get consumers, particularly those in lower income segments, to pay for the additional transaction costs incurred when using mobile money payments.

To some extent, this explains the relative success of mobile money payments in post-paid or bill payment applications for households, where the transaction fee is much smaller in proportion to typically larger bills for higher consumption. Water service providers should compare the cost of cash collection and mobile money transaction costs to analyse the benefits of absorbing the transaction fees themselves or negotiating with mobile operators in lieu of the increased revenues to reach new potential mobile money users. For instance, CityTaps realised that subscriber micropayments were almost half the lowest tariff provided by their MNO partner Orange Niger, with a transaction cost of 100 CFA francs (approximately USD 0.20). They managed to negotiate this rate with the operator and introduce a new tariff of 500 to 1,000 CFA, with half the original transaction charge of 50 CFA.

Image courtesy of Safe Water Network

3. Grundfos, "Grundfos Lifelink projects in Kenya – connecting the link to sustainable water supply" https://www.grundfos.com/cases/find-case/grundfos-lifelink-projects-in-kenya.html
4. Piramal Sarvajal, "Water ATM", http://www.sarvajal.com/water-atm.php
5. eWATER is a technology provider that harnesses mobile and solar technologies to develop affordable and sustainable water systems in Africa.
6. GSMA M4D Utilities, 2017, "Going greenfield with utility pay-as-you-go models", https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2017/12/Going-greenfield-with-utility-pay-as-you-go-models-Enabling-access-to-water-sanitation-and-energy-in-and-beyond-East-Africa.pdf.
7. https://www.gsma.com/mobilefordevelopment/programme/m4dutilities/manobi-deploying-mobile-payments-and-tools-for-rural-water-utilities-in-benin/
8. GSMA, 2018, "Manobi: Deploying mobile payments and tools for rural water utilities in Benin", https://www.gsma.com/mobilefordevelopment/programme/m4dutilities/manobi-deploying-mobile-payments-and-tools-for-rural-water-utilities-in-benin/

b. Water point monitoring is key to sustainable water delivery models, but needs to be backed up with action

Although expanding water supply infrastructure is vital (installing hand pumps, boreholes, piped networks, taps, etc.), it is just the first step in ensuring water is accessible. Maintenance and upkeep of existing infrastructure is equally important to ensuring continuity of supply and minimising the physical and financial losses from wasted water. This requires stakeholders from across the water value chain to communicate and coordinate.

A variety of mobile-enabled use cases support the exchange of **valuable real-time data** for efficient water monitoring and delivery, such as monitoring the functionality of water delivery points, water consumption patterns, leakages, broken meters and user feedback on a regular and on-demand basis. This can be done **manually** by water service attendants or end users who report it through mobile channels (voice, SMS, apps) to water service providers, or **remotely and automatically** using machine-to-machine (M2M) technology without human intervention at the reporting stages.

In our 2016 report, *Improving water service delivery through mobile data collection*, we explored the **merits and drawbacks of manual and remote monitoring**. We concluded that while real-time monitoring may, in theory, be the most accurate and timely way to collect data, manual monitoring can save on hardware development and maintenance costs, especially in emerging markets where the costs of sensors (design, manufacturing and maintenance) and batteries can be higher than labour costs. However, the overall cost of manual monitoring also includes incentivising and training staff, which brings the risk of unreliable reporting patterns and human error. For example, in Angola, DWA caretakers who reported regularly were rewarded with entry into a lottery for free airtime, but only 15 to 22 per cent reported regularly, up to 55 per cent never reported and the remainder reported only intermittently.[9] In the current landscape, the choice between manual or remote monitoring must be made on a case-by-case basis.

Without a clear purpose and plan of action, data collection is meaningless. How insights from the data will be acted upon and who will be responsible must be clearly defined prior to implementation. For example, non-profit organisation Welldone[10] trialled an alert system using their Mobile Monitor (MoMo) sensors fitted on hand pumps to inform agents or water service providers about broken water points. However, the trial was unsuccessful because of the high density of local wells and hand pumps; if one was broken the community could easily go to another, so there was no incentive to fix broken pumps. This was a classic case of collecting data that did not translate into solving problems.[11]

Just as good data is vital to attracting attention and resources, data that is unstandardised, or paper based is of little use. Digital data can sometimes sit unused on a local office computer, and password-protected management information systems and poor dissemination can also prevent data from being used.[12] Even if data is collected and stored in an actionable format, using it to drive investment can still be difficult.

For business models that involve preventive maintenance and water payments, water point monitoring is considered the most effective approach as data use is integral to service delivery. For example, Environmental Monitoring Solutions (EMS) and Vergnet Hydro are both using remote monitoring for preventive maintenance and offer strong use cases for data collection by enabling a service model (Vergnet) and leveraging M2M data for maintenance (EMS). Another interesting example is FundiFix/Oxwater, which combines remote monitoring of rural hand pumps with M-Pesa payments (although there is no locking mechanism) and government subsidies, an important part of rural water delivery.

9. GSMA, 2016, "Mobile for Development Utilities: Improving water service delivery through mobile data collection", https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2016/06/M4D-Utilities-Improving-water-service-delivery-through-mobile-data-collection.pdf
10. https://welldone.org/
11. Source: GSMA interviews
12. IRC, 2017, "Harnessing water point data to improve drinking water services", https://www.ircwash.org/resources/harnessing-water-point-data-improve-water-drinking-services.

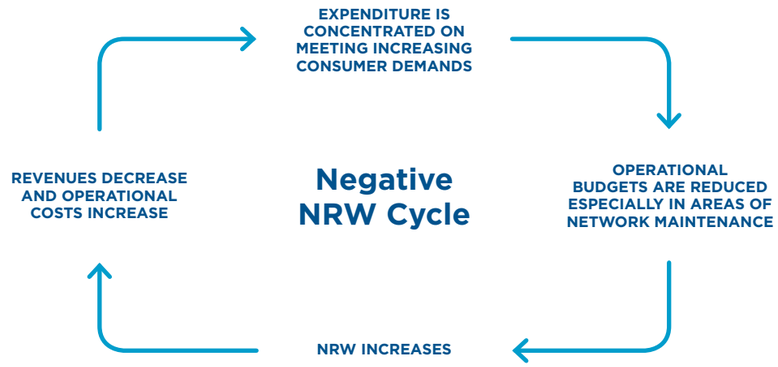
One of our grantees, Uduma, is trialling e-pumps in 11 municipalities in Mali. These hand pumps are equipped with a water meter and an automatic meter reading device (data logger), making it possible to monitor water consumption and pump breakdowns. At the same time, Uduma is developing a cashless payment system using an offline POS terminal operated by pump caretakers. Customers pay for the amount of water they want through their personal RFID water card, which is connected to their mobile money account and can be topped up at local sales points and agents. The customer pumps the water they have paid for, while the caretaker verifies the volume to guard against spillage and abuse.

c. Digitisation is helping utilities reduce non-revenue water

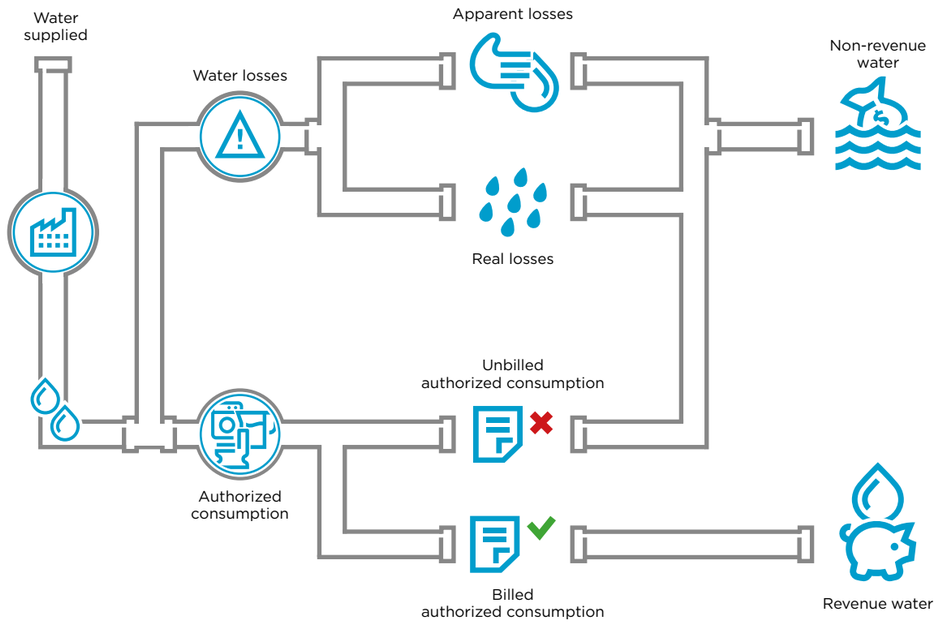
Decentralised water supply solutions are only a small part of the water delivery mix. The bigger portion of the pie, and arguably the more valuable to digitise due to the sheer scale and existing processes, is centralised utilities that build, manage and operate piped water networks. These utilities often suffer from high rates of non-revenue water (NRW), which usually includes physical and commercial losses from infrastructural problems (such as leaking pipes) or commercial issues, such as incorrect billing, faulty meters and illegal connections to water networks. Utilities with high NRW rates fail to collect revenue for the amount of water they treat and distribute, and thus cannot provide a sustained and reliable service for their customers. Lacking the resources to fix problems and extend the network, customers can become reluctant to pay for a poor service, further reducing the revenue available for network improvements.[13]

FIGURE 3 SOURCE: USAID (2010) THE MANAGER'S NON-REVENUE WATER HANDBOOK FOR AFRICA

Negative non-revenue water cycle



13. Water and Sanitation for the Urban Poor, 2017, "Balancing financial viability and user affordability: an assessment of six WASH service delivery models", https://www.wsup.com/insights/balancing-financial-viability-and-user-affordability-an-assessment-of-six-wash-service-delivery-models/



Digitising processes, such as meter reading, billing, payments and complaint management systems, have shown a clear reduction in NRW for many utilities. In Niger, CityTaps' initial pilot showed that if the CTSuite solution was deployed by the Niamey utility to SEEN's 205,000 subscribers, it would have generated a constant, positive cash balance of more than GBP 500,000. Since all payments would be made with the prepaid meter, the utility provider would have cash in hand rather than waiting to collect payments after billing clients. CTSuite saved30 per cent of operating expenditures (OPEX) for billing (i.e. reading meters, establishing and distributing bills, collecting payments, writing off bad debts and disconnecting delinquent direct users).[14] In peri-urban areas of Ghana, our grantee Safe Water Network (SWN)[15] trialled the digitisation of operational data collection for their water stations. Transitioning away from a manual paper-based system to a mobile app to input water station data like sales, meter reading and water quality, led to a 50 per cent reduction in station monitoring costs (headquarter staff travel and accommodation to station locations), and reduced monthly downtime from 12 to eight hours per month from real-time reporting.

However, executing utility-wide technology changes requires a strong commitment and partnerships between the utilities and technology and mobile network providers.

14. GSMA, 2018, "Bringing water to every urban home with the power of mobile – an update on our grantee, CityTaps", https://www.gsma.com/mobilefordevelopment/programme/m4dutilities/bringing-water-to-every-urban-home-with-the-power-of-mobile-an-update-on-our-grantee-citytaps/
15. GSMA, 2017, "Reducing water station operational costs through mobile monitoring", https://www.gsma.com/mobilefordevelopment/programme/m4dutilities/reducing-water-station-operational-costs-through-mobile-monitoring

1. The first challenge **is getting buy-in from senior management in the utilities**. This requires a clear analysis of the return on investment that can be expected from digitisation and thorough research into the utility's structure and operations. Because digitisation can bring the fear of job cuts and layoffs, software solution provider Wonderkid conducts sessions with its employees to allay these concerns and show them how reducing NRW through their suite of mobile tools (see case study below) actually has a positive effect on their jobs and salaries. For example, Kisumu Water in Nairobi used additional revenues to introduce a rewards and recognition program for staff that included shopping vouchers and team lunches.

2. There are **inherent differences in the organisational cultures of traditional utilities and start-ups/private sector enterprises**.

   a. Dealing with a utility's lengthy procedures can be difficult for entrepreneurs who may be pressed for time and cash to demonstrate the viability of their business models.

   b. Government entities can be risk averse, which puts the onus on start-ups to assume most of the risk. Utilities may also not be structured to support small pilots, which can make it difficult to seek adequate support and prompt communication. The CityTaps pilot demonstrated that utility staff had neither the capacity to support the pilot nor the ability to invest more resources.

3. While all utilities are interested in live monitoring data on water flow, **not all have accurate customer databases**. This was an issue for NextDrop in India, whose outdated maps of piped water networks in Bangalore led to inaccuracies in the water alerts sent to customers. Another grantee, Upande in Kenya, addressed similar issues during their grant, and introduced customer identification surveys to help field staff collect customer details and input them on cloud servers to compare them with existing customer details on the utility's system.

4. Finally, the **financial status of utilities** (usually determined by NRW) can pose another challenge. While bigger utilities are in a better position to pay for technological upgrades, smaller ones can be dependent on donor or government support, and both Upande and NextDrop experienced delays in being paid by the utilities. However, there is also an opportunity given the potential savings of reducing non-revenue water through mobile-enabled solutions.

Image courtesy of Wonderkid

Wonderkid: Digitising water utilities in Kenya

Wonderkid in Kenya is a successful example of all three trends outlined in this report: water delivery monitoring, bill payments and digitising utilities. As part of a grant through the GSMA M4D Utilities Innovation Fund, Wonderkid developed a suite of mobile tools for water utilities in Kenya, Kisumu Water and Sanitation Company (KIWASCO), Muranga Water and Sanitation Company (MUWASCO), Kakamega Water and Sanitation Company (KACWASCO) and Malindi Water and Sanitation Company (MAWASCO), to adapt and scale the following tools:

- Complaint management and tracking system that allows customers to call or SMS complaints, report leakages or make general queries, helping utilities ensure their response times are within those set out in their customer charters.
- Mobile app for meter reading that allows meters to be photographed to address disputes, meter readers to receive their assignments remotely and office supervisors to verify meter readers' activities in real time.
- Self-meter reading and payment system that allows users to submit their own meter reading via SMS and receive a preliminary bill with instructions for paying via mobile money. Households that are not home at the time the meter is read are sent an SMS notification that prompts them to do this.

The following are some key lessons from the project:

1. Digitising manual processes can lead to tangible changes in operational efficiency. The efficiency of meter readers (calculated as the total number of meters on which readings were reported divided by the number of meter readers) at KIWASCO increased by eight per cent from the launch of the service in August 2015 to December 2016. The complaint management time. For KIWASCO, the resolution time customer complaints dropped by more than 15 days in the same period.
2. Data collection can have a variety of productive uses, such as data-based performance reviews for Wonderkid staff. The KIWASCO team developed a performance reward matrix based on the IMUM system, a suite of services including meter reading and complaint management applications.
3. Strong marketing campaigns can spur trial-based adoption of new technologies, but active, regular customer use of new tools requires sustained effort. In November 2015, a focussed door-to-door campaign was rolled out to inform customers of various services. This led to a sharp increase in usage of both Soma Mita and Bill Query, but it dipped soon after as customers returned to their usual methods.
4. Even in countries with high rates of mobile money adoption, utility payments can be a strong factor in driving adoption and active use. Between August 2015 and December 2016, the number of mobile money transactions to pay bills at KIWASCO increased by 71 per cent and the value of the transactions increased by 50 per cent.
5. Bundling services (handsets, data, broadband, device management, mobile money integration, bill management application for customers, USSD integration, SMS packs, short code, etc.) can be a very effective way to drive customer adoption and stickiness with the new services.

Wonderkid now serves over 22 utilities across Africa, providing services that are accessible to over four million customers using mobile platforms.

Image courtesy of Safe Water Network

16. GSMA, 2017, "Wonderkid Multimedia LTD. Digitising water utilities in Kenya", https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2017/11/Wonderkid-Multimedia-LTD-Using-mobile-to-digitally-transform-water-utilities-in-Kenya.pdf

3. Accelerating the growth of mobile-enabled water services

Mobile-enabled water models are finally beginning to follow in the footsteps of the energy sector and seem to be gaining some momentum. However, what might appear to be a simple transposition of a successful business model into the water sector has not been straightforward. As discussed earlier, customer resistance to pay for water, the sheer necessity of water for survival, the ready availability of alternative (although unclean) sources of water, and the profitability of water service providers in a low-margin environment make the water sector unique.

We see potential in three approaches to accelerating growth in mobile-enabled water access:

a. **More mobile partnerships:** PAYG solar providers have long partnered with mobile operators, leveraging their known and trusted brand and deep distribution networks. However, the water sector is somewhat more nuanced. First, the continuity of an adequate and clean water supply is more life-critical than energy, making unreliable mobile network coverage in IoT-based applications or water payments a barrier for water service providers. More water sector players have been turning to third-party IoT connectivity providers, such as Aeris and Eseye, for more suitable and stable connectivity solutions, or for international SIMs that can switch between networks. For example, Upande in Kenya had to use both Safaricom and Airtel SIM cards as neither operator could offer full coverage in its deployment area. Expanding reliable mobile network coverage is therefore important to resolving these issues.

   Second, mobile operators are more likely to work with big water utilities (often post-paid water) that help them target more customers with a single integration. This can be a barrier for players seeking to partner on smaller scale projects, but both water utilities and mobile operators stand to benefit from supporting pre-paid water payments that not only provide timely and fair bill payments for the underserved, but also encourage more frequent use of mobile money wallets.

b. Bundling: The premise is simple: if water payments are too small to make decentralised water services a financially viable solution, can bundling them with other services (sanitation, waste and energy) that target the same users be a solution? The GSMA M4D Utilities programme recently awarded a grant to mobile operator Robi and Practical Action in Bangladesh to build an integrated platform that will allow customers to request services and pay through an app, SMS, USSD or voice calls (for human waste collection, electrical, plumbing, sanitation and drainage, or reporting municipal problems).[17]

Adding high-margin, value-added services, such as refrigeration, home delivery, non-water products and laundry services, could help overcome low margins in the water sector. In Haiti, DloHaiti[18] is experimenting with this and found that 30 per cent of their current revenues come from the sale of secondary products (such as deodorants, shampoo and toothpaste), while 70 per cent come from the sale of water. Samagra, a clean toilet kiosk provider in India, also provides bundled products and services as part of their business model.[19]

c. Value chain specialisation and platform as a service: This is a very visible trend in the energy sector where players like BBOXX, Angaza and others are setting up franchising models in which they licence their software to other PAYG players, reducing the entry barriers for end-to-end providers. A similar business model in the water sector could help local water service providers scale their business models. Wonderkid's solutions are an excellent example of how this is already being used successfully by urban utilities in Kenya, and Manobi in West Africa has successfully deployed its mWater system in urban and rural Senegal, as well as an entire water point system in rural Benin.

We anticipate that the current pilots will help to drive more interest among utilities, water providers, governments and mobile operators. The next step will be testing whether more transparent and efficient collection of water payments through mobile will make water service providers more investable, as we have seen with energy.

17. GSMA grantee details: Robi Axiata, https://www.gsma.com/mobilefordevelopment/mgrantee/robi-axiata/
18. https://www.dlohaiti.com/
19. Toilet Board Coalition, 2016, "The digitisation of sanitation: Transformation to smart, scalable and aspirational sanitation for all", http://www.toiletboard.org/media/18-Digitisation_of_Sanitation.pdf

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GSMA HEAD OFFICE
Floor 2
The Walbrook Building
25 Walbrook
London EC4N 8AF
United Kingdom
Tel: +44 (0)20 7356 0600
Fax: +44 (0)20 7356 0601