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A NEW MODEL TO OPERATE AND MAINTAIN RURAL WATER INFRASTRUCTURE IN THE ARID LANDS OF KENYA

FINAL FINDINGS AND EVALUATION
MAY 2023

In collaboration with OXFAM

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1. BACKGROUND

1.a. Origin and rationale of the pilot

In the past 20 years, Kenya has received massive capital investments in the water sector (e.g. 4 fold increase in donor funding from 2006 to 2009[1]). However, access to improved water supply has increased slowly: the percentage of Kenyans with access to at least basic drinking water services increased only 7% between 2000 and 2015 (from 46% to 53%)[2]. Therefore, it appears that these investments have not resulted in proportional improvements for citizens.

One of the main reasons for this situation is the disregard of one of the most challenging aspects of water infrastructure development – namely the funding and management of O&M. In fact, the standard model for donor-funded water projects only pays for capital expenditure and does not envisage hardly any provision for operations and maintenance. Communities are left by themselves afterwards, after one-time basic governance and technical training. As a result, water related infrastructure goes to waste: 2/3 of rural water systems in the ASALs are severely dysfunctional within 3-5 years of construction, and about 1/3 are non-functional at any point in time[3]. These consequences are particularly acute in rural remote communities.

In light of the above situation, an innovative O&M approach for rural water systems was co-developed by Oxfam and LeFil Consulting, with the support of the Turkana County Government (TCG), Partnering for Green Growth (P4G), the Waterloo Foundation, the Swiss Agency for Development and Cooperation (SDC) and the German Federal Foreign Office (GFFO). Overall, this approach strives to deliver effective and efficient O&M, using 3 main levers: i) making infrastructure last longer at lower cost by channeling more resources into professional and cost- effective maintenance services; ii) avoiding tariff leakage; and iii) ensuring the continuous availability of funds for O&M[4]. In order to assess the economic feasibility of this approach, the first and second levers were piloted in 60 rural stand-alone water systems in the ASALs of Kenya[5]. A successful pilot would trigger the implementation of the third lever and pave the way for a wider adoption of this O&M model at national level.

1 Water supply and sanitation in Kenya, Water & Sanitation Program (World Bank), 2015

2 Progress on drinking water, sanitation and hygiene, JMP (WHO and Unicef), 2017

3 Sources: Water supply and sanitation in Kenya, Water & Sanitation Program (World Bank), 2015; Water service delivery as a business: an approach to sustaining water services in rural areas, Tiwari, 2013.

4 We would recommend setting up a dedicated O&M fund, operated under the County's government oversight, which would finance the O&M expenses for rural water schemes. The fund would pool resources across a selected group of schemes, and disburse them on the basis of clearly defined priorities and rules. This fund would be fed by 2 revenue streams: 1) a 7% tax on any new water development infrastructure, taxed mostly on donors; 2) a share of water tariffs, as available. This design would allow risk-spreading and cross-subsidization across schemes, without excessively penalizing better performing schemes with the problems of lesser performing ones. It should also incentivize spending on better-quality infrastructure, and hence reduce the burden of schemes 'set to fail' after generating very high O&M expenditures.

5 Out of the 60 target schemes selected in the beginning, 6 were replaced by control schemes due to substandard state of the infrastructure before the start of the pilot, 2 were off-boarded for the same reason during the pilot (but not replaced) and 1 was off-boarded due to a severe breakdown during the pilot (but not replaced). Thus, the pilot consisted of 57 schemes.

1.b. Key design principles and hypothesis questions

This pilot was designed to test 6 main hypotheses. These are the following:

- Hypothesis 1: If proper O&M (preventative and curative) is ensured, the infrastructure will work longer and the repairs will become less frequent and cheaper. As a result, the communities will be better served, and we could jumpstart a market for O&M services across the water sector, which is now almost exclusively focused on capex-related work.
- Hypothesis 2: The Turkana County Government (TCG) and the Water User Committees (WUCs) do not have the capabilities and the resources to deliver the level of O&M required. Hence, we need to hire a professional, dedicated service provider to ensure that function.
- Hypothesis 3: If the right size, budget, incentives, etc. is provided, a private operator can set itself up to deliver this intervention up to the required standards, at scale.
- Hypothesis 4: If data shows that it makes more economic sense to invest in O&M rather than capex (i.e., new infrastructure), this pilot will provide evidence to change the way money gets invested in water in the County (and influence legislation/ funding mechanisms accordingly).
- Hypothesis 5: If a better level of service is provided, the communities will pay more, feel more ownership, protect the infrastructure better, etc.
- Hypothesis 6: An automated mechanism to pay for water tariffs would increase tariff revenue through better collection rate and reduced opportunity for corruption and fund misappropriation.

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1.c. Pilot set-up overview (roles and responsibilities of stakeholders)

The pilot was implemented and sponsored by a wide range of players, each with distinct roles:

The County was responsible for providing funding of a maximum of KES20M for initial works (to bring the targeted water schemes to a basic level of functionality); supporting the planning of any field visits; overseeing implementation; ensuring proper reporting, compliance and accountability.

Oxfam was responsible for reaching out to donors to pay for the pilot; working with 2 counties to identify possible target water schemes (in the end we settled for Turkana only); conducting policy advocacy efforts to ensure ongoing engagement and commitment of county authorities; developing an MoU with the partner county government; orchestrating the enrollment of the target water schemes and corresponding WUCs; identifying potential private sector operators; overseeing pilot implementation; ensuring the payment of KES13M to and monitoring the performance of the O&M Service Provider (in this case Epicenter), including regular coordination meetings, and quality control of the works performed.

LeFil Consulting was responsible for reaching out to donors to pay for the pilot; designing the bundled service agreement; conducting a feasibility study on automated payment collection and setting it up together with Safaricom; managing the M-PESA transactions on a case by case basis; developing data collection methodology and M&E approach to track and assess pilot impact between pilot schemes and control groups; overseeing Epicenter's work day-to-day; reviewing quotes and doing continuous financial management/ monitoring; solving and/or escalating any quality, compliance or implementation issues; collecting M&E data on the pilot schemes for the baseline and the endline through a local implementation partner; analyzing pilot data and assess results and impact; conducting control checks and keeping all stakeholders on track; developing all tools and processes needed to perform the above activities.

Epicenter was contracted as a professional service provider and was responsible for providing the following services to all water target schemes: set up a local presence in Turkana County, including renting an office and hiring local personnel; 2 rounds of preventative visits per schemes; curative works as required; reporting and recording of the work done; 1 water quality testing per scheme. A novel procurement procedure was set in place in order to provide financial security to the operator: on one hand, the overhead costs – including office, salaries of administrative personnel, licenses,

water analysis, equipment for curative works, equipment and materials for preventative works and field staff costs - were paid upfront, independently of the number and type of works performed. On the other hand, the variable costs were paid on actuals depending on the nature of the works needed/ performed. In this case, Epicenter was responsible to prepare and submit quotes, LeFil and Oxfam would jointly review those, and Oxfam would approve them (or not)[6].

Beneficiary communities confirmed their respective WUCs, whereby the chairman was in charge of overseeing the functioning of the water scheme and contacting the service provider in case of a problem; the treasurer was in charge of collecting the water tariffs and transferring them to a dedicated M-PESA paybill. On top of that, communities also designated local field staff in order to manage the day to day operations of the schemes. According to the specific set-up of each water scheme, the communities could designate:

- A pump operator who would manage daily the water scheme's extraction subsystem
- A kiosk attendant who would manage daily the water distribution points
- A guard who would look after the solar panel infrastructure to prevent it from being stolen or vandalized.

All the members of the communities were supposed to pay a water tariff in order to use the water scheme. The investment in O&M was conditional on the communities paying tariff[7]. That is, the communities were told that no repair would be performed if tariffs were not paid. The tariff money was intended to cover the salaries of the local community staff.

Finally, Grundfos was tasked with installing water ATMs in 2 communities, against remuneration. These were installed towards the very end of the pilot, following difficulties in identifying suitable locations for this effort. This evaluation does not include an assessment of the relevance or impact of this intervention.

6 More specifically: When the provider identified the need of a curative repair which required funding, either following a community call or by their own assessment during preventative visits, he/she requested a quote which comprised the cost of all necessary materials to fix the breakdown at stake. At this stage, Oxfam decided whether to approve the quote or not. On top of that, the operator could claim travel costs and per diems for each work – set amounts were agreed upon contract.

7 When the provider identified the need of a curative repair which did not require funding, the operator could only claim set travel costs and per diems for each work performed. The provider could also claim set travel costs and per diems for each preventative visit. Due to the drought response, this condition was not implemented. All water schemes were considered for rehabilitation regardless of their water tariff contributions.

2. METHODOLOGY

2.a. Overview of selection methodology for control and target schemes

In the first place, the TCG attempted to map all water schemes in Turkana. Once that list was put together, those fulfilling the requirements to participate in the pilot (i.e. stand-alone water systems in rural areas serving small to middle communities, partially functional, and solar powered) were randomly assigned to a control group (30 water schemes)[8] or the target group (60 water schemes). The O&M model was implemented in the target group whereas the control group did not receive any intervention from the pilot, for a period of 1 year.

Of note, the pilot design targeted, at the onset, a large number of schemes (i.e. 60). The reasons for this were two-fold: first, it was important to do this at a level of scale that would truly demonstrate the true feasibility and complexity of managing an intervention of this magnitude; second, we wanted to engage the private O&M operator at a level where it would make economic sense for this company to truly invest into the required team, infrastructure, processes and tools for longer-term O&M service provision (rather than merely bidding for a small-scale, short-term project focusing mostly on construction).

2.b. Overview of data tracking mechanism

In order to assess the achievements and the cost of the pilot, financial, operational and performance data was collected from both groups before and after the program implementation. An external consultant was hired to conduct the baseline data collection (whereby the endline was performed by both LeFil and Oxfam).

Overall, the data collected allows to assess the system's functionality, the size of households and livestock served, the operational costs of running a water system (i.e. field staff costs and other operational costs), scheme finances and revenues (i.e. tariff collection), the need of repairs, communities' satisfaction and increased abilities.

Furthermore, during the implementation of the program, extensive data was collected on the O&M service provider's work, in order to evaluate the level of performance, efficiency and speed.

8 Out of the 30 schemes selected in the control group, 6 were moved to the target group in order to replace schemes with unexpected substandard infrastructure before the start of the pilot and 2 were off-boarded due to substandard infrastructure. Hence, the control group actually consisted of 22 schemes.

3. SCHEMES' OVERVIEW

3.a. Overall data on schemes, including users, type of systems in place and functionality level

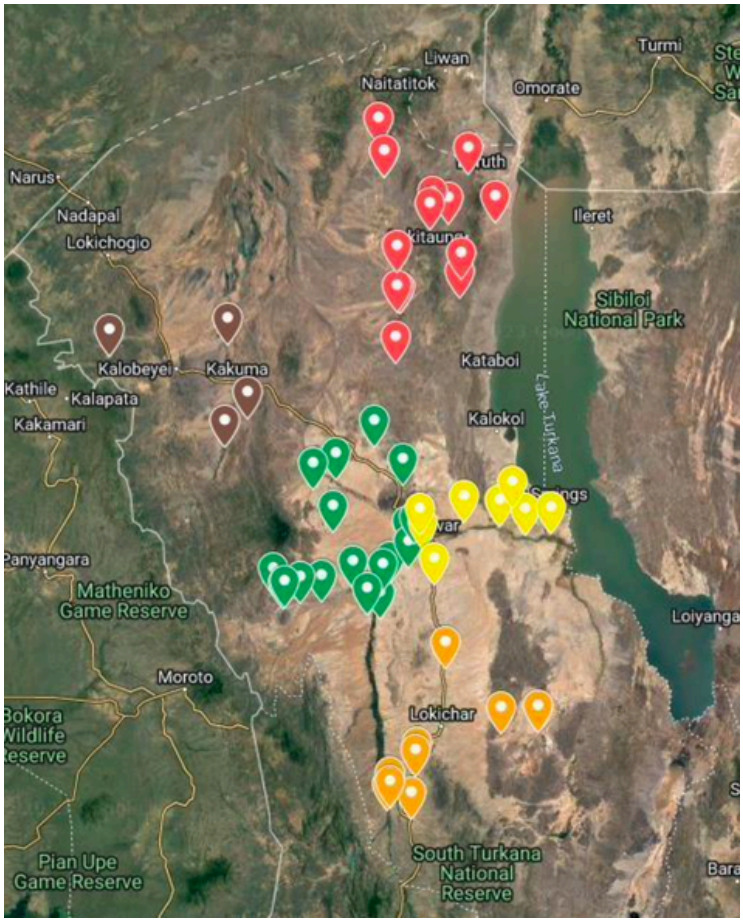
The pilot targeted stand-alone water systems in rural areas that are somewhat far away from urban centers, serve very small, small and sometimes medium-sized villages, that do not fall under the direct management of the local water utility. The chosen schemes also had to be at least partially functional and solar powered.

On average, the water schemes participating in the pilot served 229 households, and between 0 and 15,000 heads of livestock (depending on season and location). Most of the schemes are solar (90%), followed by solar diesel hybrid (8%) and generator systems (2%).[9]

Regarding functionality, most of the water schemes were fully functional at the beginning of the program (target: 67% vs. control: 50%). The rest of the schemes were partially functional (target: 28% vs. control: 45%) and some were non-functional (target: 5% vs. control 5%). In terms of infrastructure, most of the systems consisted of boreholes (often located near surface water sources), overhead tanks and nearly no home connections.

In terms of water quality, in the beginning of the program, 30% of schemes had levels of sodium above benchmark (i.e. 200 mg/L); 40% of them had levels of fluoride above benchmark (i.e. 1,5 mg/L); and 26% of them recorded the presence of the bacteria Escherichia coli.

Schemes participating in the pilot by county, Turkana, Kenya



9 This consists of 1 scheme in the control group.

4. O&M COSTS OVERVIEW

In this section, we present all costs associated with the O&M pilot. These costs were covered by the following Oxfam, LeFil Consulting, the TCG, Partnering for Green Growth (P4G), the Waterloo Foundation, the Swiss Agency for Development and Cooperation (SDC) and the German Federal Foreign Office (GFFO).

4.a. Donors' contribution towards curative repairs

At the end of the pilot, the number of curative repairs in the target group amounted to 116, out of which 73 (63%) required a quote with an average cost of KES223,974. To this, one should add 46% in travel costs, per diems and overhead. While all repairs that did not require a quote responded to small breakdowns, 51% of the repairs requiring a quote responded to a large breakdown, 42% to a medium breakdown and 7% to a small breakdown. Comparatively, in the control group, only 3 (large) repairs were effected over the same period, with an average cost per repair of KES230,590[10](NB: the frequency of repairs is not necessarily a reflection of the needs, but rather of the availability of funding for those).

Not all quotes were approved, as there was limited budget. Multiple criteria were used to prioritize works over time: first, we set limits per scheme, to safeguard a minimum amount of resources for each scheme, second, we prioritized works that would improve significantly availability first, accessibility second, and quality third. Also, when the required repairs were just too large (e.g. borehole collapse), the water scheme was 'abandoned', i.e. it was no more part of the pilot. As a result, 11% of the processed quotes excluded some items of the original quote due to insufficient budget. Besides, 8 quotes were not approved because of a lack of budget. Besides, the operator was expected to solve curative repairs within a certain time span. If the response time surpassed the target, the operator received less money for its work. In fact, each day of delay reduced the operator's revenue by KES146 per scheme. At the end of the pilot, KES92,507 were deducted from the operator's bill for this reason, thus reducing marginally the cost of curative works.

4.b. Donors' contribution towards preventative maintenance

At the end of the pilot, the number of preventative visits in the target group amounted to 116. While the cost of materials for these visits was predefined and budgeted for 120 visits (i.e. 2 visits per scheme), the operator could claim per-agreed travel costs and per diem costs for each visit. Hence, the average cost of materials and equipment budgeted was KES 5,733 per scheme and the average cost of travel costs and per diems was KES 26,320. In terms of hours worked, on average a curative repair took 18 hours, i.e. 2.2 days working 8 hours per day, whereas a preventative visit took 5 hours.

10 60%+ schemes which performed a curative repair in the control group did not remember the cost of the repair. Therefore, the cost of the curative repair for these schemes was estimated based on the repair costs for similar works in the target group.

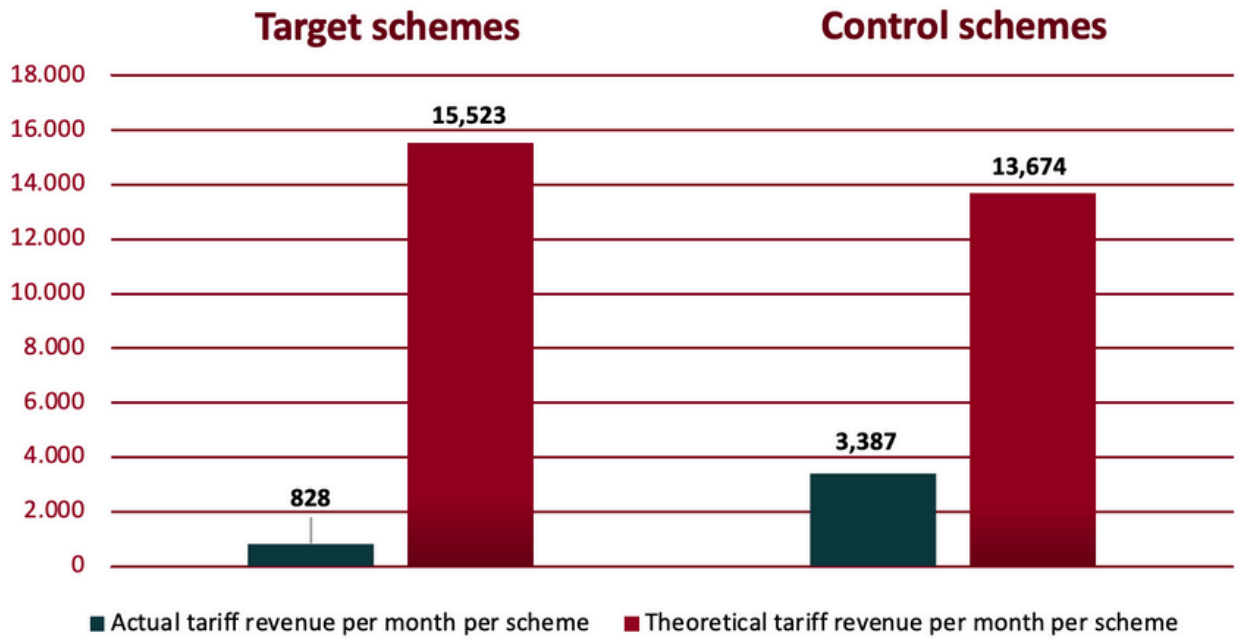
4.c. Contribution of TCG towards curative repairs

The TCG also contributed to the pilot by performing and/or funding curative repairs, which were meant to rehabilitate target schemes prior to pilot start. Overall, the county's contribution amounted to KES 1,453,921. Regarding the types of works performed, this financing contributed to fixing 6 pumps/boreholes, 3 water storage infrastructures and 5 main lines/secondary lines, totaling to 14 works performed. However, the TCG did not proceed with 9 additional repairs, which were required but postponed for lack of funding. These unperformed works amount to an estimated KES 721,921.

4.d. Tariff payment towards local operational costs

Communities also contributed to the pilot by covering operational costs, i.e. field staff and fuel, through tariff payment. At the end of the program, total tariff paid in the target group amounted to KES 613,439, meaning that each scheme paid per month an average of KES 828. Assuming a best-case scenario where 80% of households would pay during the dry season and only 50% of them would pay during wet season, tariff paid could have amounted to KES 11,502,270, meaning that each scheme would have paid per month an average of KES 15,523. This implies that the communities in the target group only paid 5% of the total tariff that could have been paid in a best-case scenario. On the other hand, the communities in the control group claimed to have paid KES 968,728 during the same time period, meaning an average monthly tariff payment per scheme of KES 3,387. In a best-case scenario, the average monthly tariff payment per scheme could amount to KES 13,674. Hence, contrarily to the target group, the control group paid 25% of the total tariff that could have been paid in a best-case scenario.

Monthly average tariff payment per scheme in both groups (in KES) – actual vs. theoretical



5. MONETARY AND NON-MONETARY BENEFITS CREATED

5.a. Monetary savings in terms of avoided large break-downs

Thanks to this pilot, we can prove that the lack of proper maintenance causes accelerated schemes' deterioration. During the course of the program, only 1 target scheme (out of 60) fell into severe dysfunctionality, i.e. costs of repair were higher than costs of reconstruction, whereas 2 schemes (out of 30) in the control group did so. This means that 2% of schemes in target group need full reconstruction, while 9% of schemes in control group fell into the same state. This implies that the pilot avoided that 7% of schemes (roughly 4 schemes) to break-down beyond repair, saving up to KES 10,166,667 in reconstruction a year[11].

5.b. Repairs completed (type and size)

Thanks to the pilot, each scheme in the target group benefited from 2.04 curative repairs. In total, 116 curative repairs were done, the majority of which responded to a small breakdown and addressed issues on the secondary distribution line. Specifically, 41% responded to small breakdowns, 32% to large breakdowns and 27% to medium breakdowns. In terms of type of repair, 32% of works were done on the secondary distribution line, 26% on the borehole/pump, 22% on the main line, 11% on the PV structure and 9% on the tank.

On the other hand, schemes in the control group managed to finance/ organize 0.14 curative repairs per scheme. In total, 3 curative repairs were done, all of them responding to a large breakdown (of note, control schemes only reported repairs responding to a large breakdown). 67% of works were performed on the borehole/pump and 33% on the tank. Hence, comparatively, the communities in the control group benefited from 22% less repairs responding to a large breakdown than those in the target group.

On top of the curative works, every target scheme received 2 preventative visits, as per contract.

11 It can be reasonably assumed that these savings would be realized on a yearly basis, at least during the first 2 years of the program

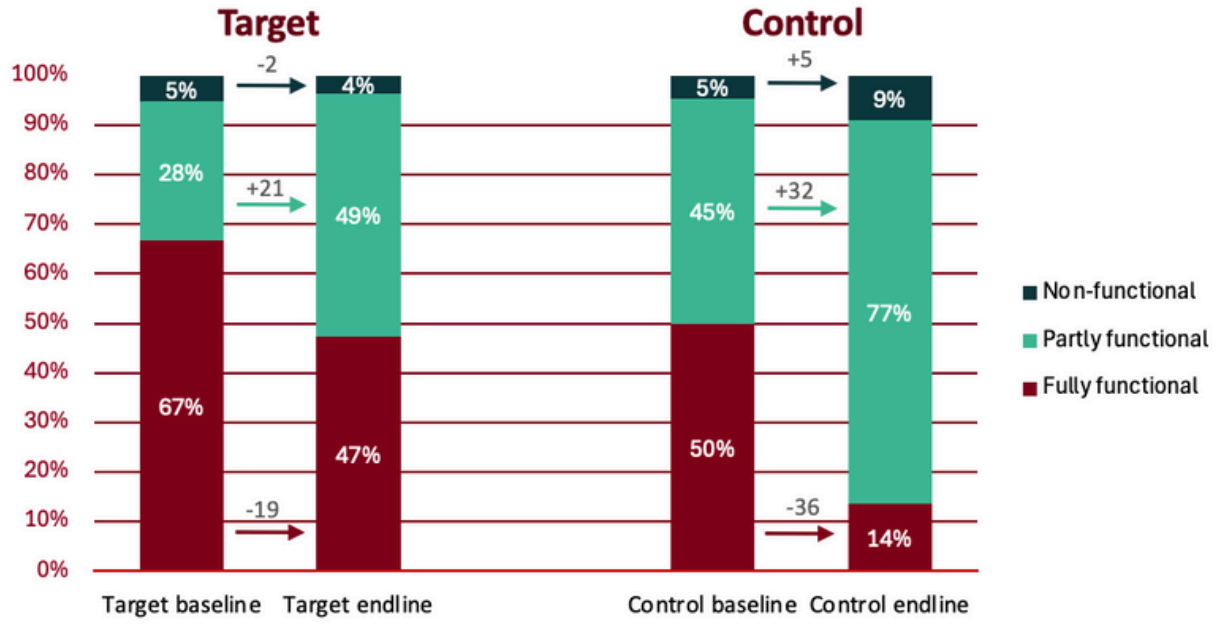
5.c. Intensity of repairs over time

The intensity of curative repairs reduced considerably between the first and the second half of the pilot (61% reduction). Although this might be due to a better management of the O&M, there are other reasons that might be driving this outcome: firstly, water schemes' infrastructure was found to be in worse condition than expected at the beginning of the pilot (perhaps due to the drought that happened between the moment when the assessment was done and the actual start of operations). Therefore, in order to bring schemes to a reasonable level of functionality, additional works had to be done during the first months of the pilot. Secondly, given a significant part of the budget was used to cover those works, the criteria to approve quotes in the second half of the pilot was more stringent resulting in less repairs approved.

5.d. Changes in functionality

In terms of functionality, the pilot managed to keep a larger proportion of schemes fully functional than in the control group. In fact, by the end of the pilot, 19% of schemes in the target group had lost functionality, going from fully-functional to partially functional. In contrast, 36% of schemes in the control group lost functionality, going from fully-functional to partially/non-functional. On top of that, the pilot avoided a larger proportion of schemes to fall into total disrepair: although both groups had 5% completely non-functional schemes at the beginning of the pilot, 4% ended up in that condition in the target group, vs. 9% of schemes in the control group, by pilot's end.

Scheme's functionality across both groups baseline vs. endline

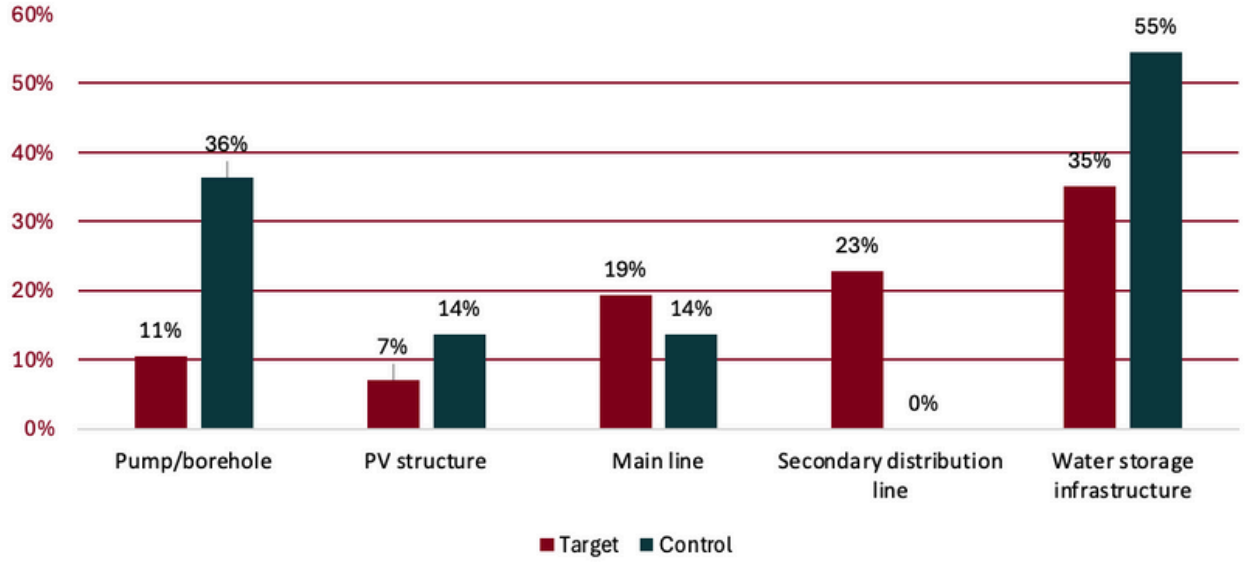


Although there were improvements in terms of functionality, additional repairs are still needed to restore full functionality in both groups. For the target group, these are the following: water storage (35%), secondary distribution line (23%), main line (19%), pump/borehole (11%) and PV structure (7%).

Photo credit: LeFil Consulting

For the control group, the repairs needed to restore full functionality are: water storage (55%), pump/borehole (36%), main line (14%), PV structure (14%) and secondary distribution line (0%). Hence, water schemes in target group need less additional repairs in almost all subparts of the system than those in control group. However, it can be noted that the control group needs less works regarding the main line and the secondary distribution line. This can be due to the fact that a dysfunctional main or secondary distribution line can only be identified if the pump/borehole is working.

Repairs still needed by type - target vs. control



5.e. Changes in security situation at the sites

The better management of the schemes has resulted in more secure infrastructure: the target group reports hazardous situations in 5% of the schemes and incidents in 2% of the schemes whereas the control group reports hazardous situations in 18% of the schemes and incidents in 5% of the schemes.

5.f. Improvements in water quality

In terms of water quality, by the end of the program, only 5% of schemes had the presence of Escherichia coli in their water. The reduction of the presence of the bacteria is a result of chlorination works for which Oxfam sought additional funds to the ones presented in the donor's contribution section. The funding amounted to KES 2,468,154. The average amount spent per targeted scheme was KES 176,297.

5.g. Levels of performance, efficiency and speed of privately outsourced O&M services vs. status quo

A private service provider was contracted to pursue the curative repairs and maintenance works. As per contract, Epicenter was subject to maintaining performance KPIs throughout the duration of the pilot. A detailed review of the attainment of those KPIs is provided below:

- The operator managed to deliver 2 preventative visits per scheme, as required.
- The operator was expected to solve curative repairs within a certain time span depending on whether they requested a quote or not, namely: 5 days to perform works for which no quote was needed and 20 days to perform works for which a quote was needed. In contrast, Epicenter experienced delays for 38% of the works not requiring a quote, and took 11 days to complete them. For the works that required a quote, the operator experienced delays with 93% of the works, and took 92 days to complete them. Comparatively, repairs in the control group reportedly took on average 1.19 more time to be performed.
- The operator was expected to respond promptly to calls made by communities (i.e. propose a visit date to the caller within 48 hours). In reality, 10% of the responses were delayed, and it took the operator 2 days to respond to incoming calls in average.

While the level of performance was lower than expected overall, some large delays were experienced because of the security issues in Turkana South. Also, the operator struggled throughout the pilot with submitting a flow of clearly documented quotes on a timely basis, possibly for lack of required staff organization/ oversight/ management and competences. Finally, no one had expected the large quantity/ high complexity of works needed at the beginning of the pilot, which created some level of backlog.

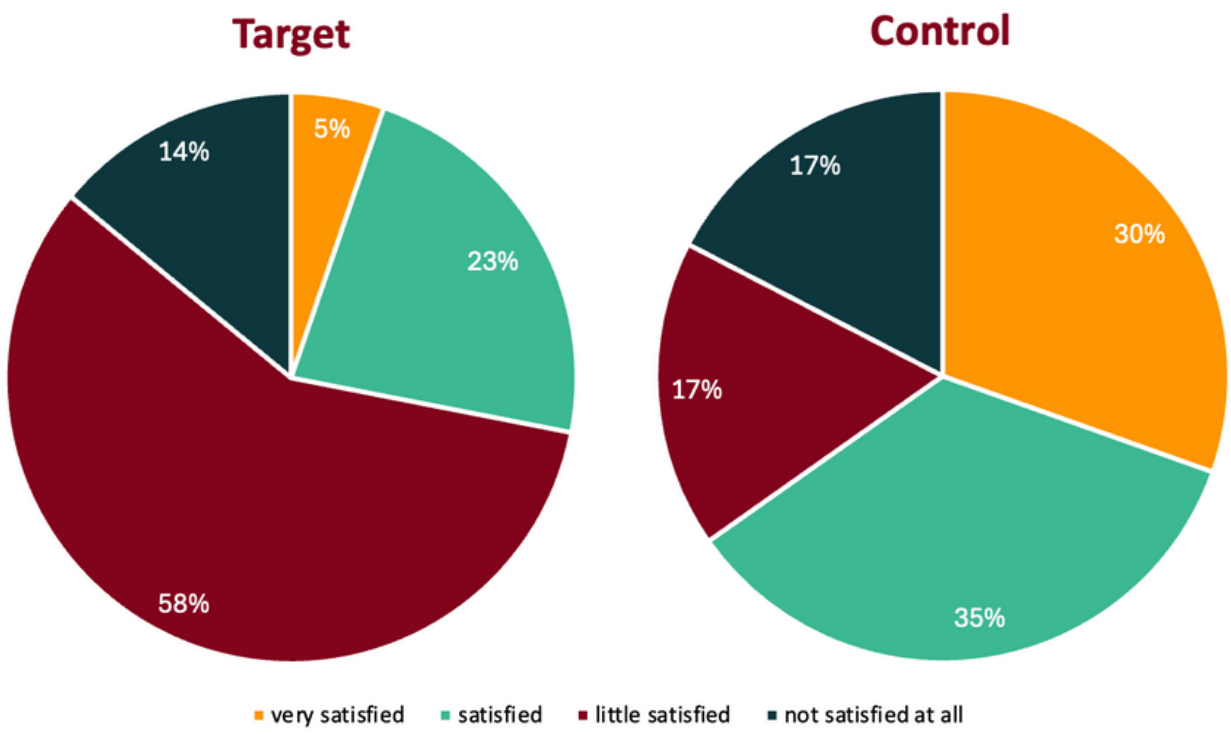
12 Number of days are counted between the date of discovery of the breakdown and the date of resolution.

13 The interviewees control group only reported those repairs responding to a major breakdown (as asking for more minor repairs would have likely generated unreliable answers).

5.h. Satisfaction of communities and remaining challenges

Contrarily to our initial expectations, 72% of the communities in the target group were little or not satisfied at all compared to 34% of communities in the control group. Besides, 28% of communities in the target group were very satisfied or satisfied whereas 65% of communities in the control group reported the same level of satisfaction. A possible explanation for this result is that the satisfaction level of two groups might not be comparable since expectations were set differently from the beginning. Certainly, the target group was promised fully functional water schemes whereas the control group was not expecting any improvement in their water infrastructure. It could be argued that the target group has a big feeling of dissatisfaction because expectations were not met even if - objectively - their schemes are better off.

Level of communities' satisfaction target vs. control



The main complaints in the target group were: the need for more infrastructure (84%), need for additional repairs (56%) and insufficient water availability (26%). In the control group, the main demands were: the need for more infrastructure (87%), additional repairs (39%) and insufficient water availability (13%). It is interesting to note that, the target group has higher expectations in terms of additional repairs needed, even though they received more repairs overall. This also may point at the possibility that the aforementioned levels of dissatisfaction could have been caused by unmet expectations rather than solely by poor pilot implementation.

5.i. Improved capacity of chairmen, treasurer and secretary

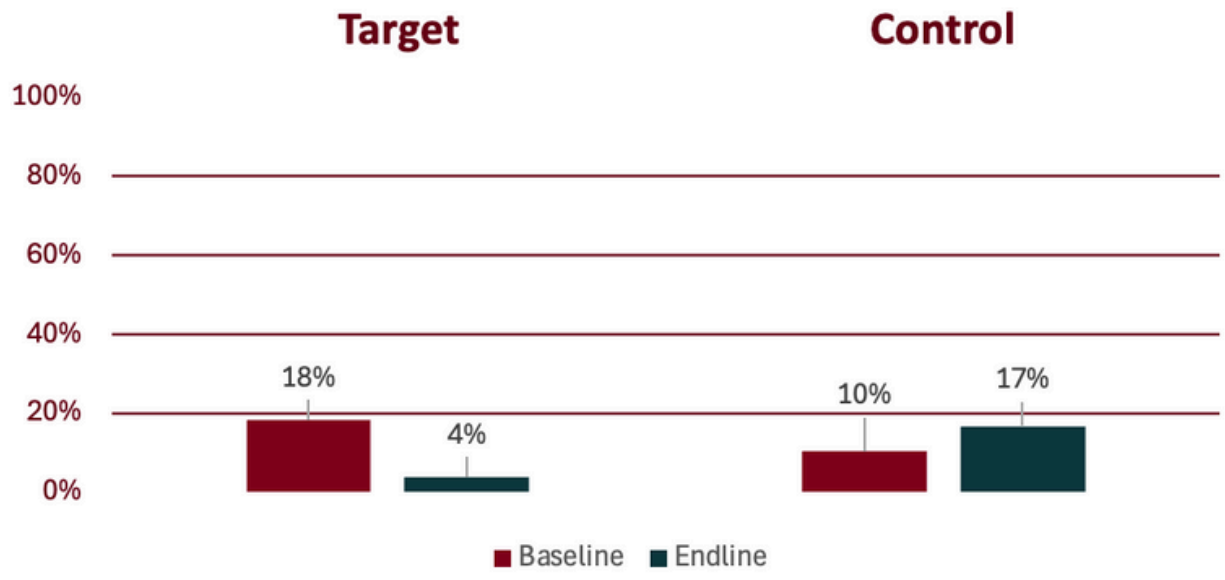
Last but not least, 13% of WUC chairmen in the control group believe that lack of training in water management, tariff collection and maintenance is one of the main challenges affecting their work. However, only 4% of chairmen in the target group do so. These results prove the pilot has managed to improve capacity of local staff as well as the members of the water committee, i.e. chairmen, treasurer and secretary to manage the water schemes.

5.j. Changes in willingness to pay tariff

Although the pilot has managed to improve the proportion of households paying for 40% of the target schemes, the payment rate actually decreased in 51% of the schemes and it remained equal in 9% of the schemes. More specifically, payment rates decreased systematically among the best performing schemes (i.e. average monthly savings realized after payment of local operational costs above KES 1,000), and in 50% of the cases, among the second-best performing schemes (i.e. average savings per month below KES 999).

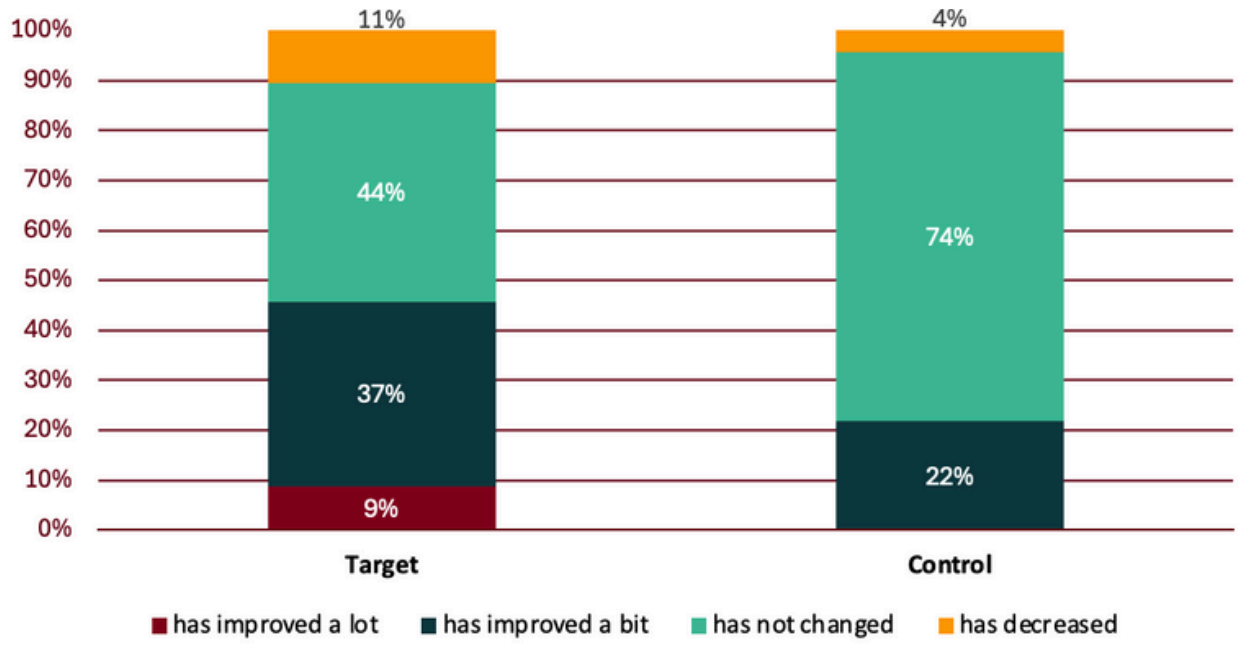
In fact, contrarily to our initial expectation, the proportion of households paying tariff in the target group had decreased over time whereas it reportedly slightly increased in the control group. The reasons are unknown however an unintended result could be due to the fact that repairs have been performed regardless of whether the community engaged in tariff payment or not (contrarily to what was announced to the communities at the onset).

Proportion of households paying tariffs in both groups - baseline vs. endline



These results also need to be compared to the WUC Chairmen's assessment of the willingness to pay tariff of his/her community. Chairmen stated that it had improved in 46% of the schemes in target group and 22% in control group; remained equal in 44% of target schemes and 74% of control schemes; decreased in 11% of target schemes and 4% of control schemes. It can be observed that improvement in the willingness to pay in the target group is similar between actuals and chairmen's perception. However, decreases in the willingness to pay was actually significantly higher than according to Chairmen's perception. A possible explanation for the disparity between actual tariff collection and chairmen's perception could be that the payment rate at the baseline was overestimated.

Change in willingness to pay according to WUC Chairmen's perception – control vs target group



Overall, 82% of schemes did not collect enough tariff to cover local staff's salaries consistently throughout the pilot (and even less save money after paying those expenses). Among those, 13% schemes did not pay tariff at all throughout the pilot. Among the other 18%, 4% managed to save less than KES 100 per month (after paying salaries), 10% between KES 100 and KES 1,000, and 4% over KES 1,000. For reference, the schemes that managed to save some money on a monthly basis recorded payment rates of 3%-25% and each scheme counted at least 84 households, pointing at the fact that schemes need to be supported by a minimum number of households to ensure some level of financial sustainability. In fact, structurally, 18% of target schemes are not able to cover local staff salaries with tariff, even with a 100% payment rate. These schemes have at maximum 150 households and 71 households on average. This implies that schemes with less than approximately 70 households are not capable to pay for local staff's salaries and thus, said staff would need to work on a voluntarily basis, making it even harder to make a case for tariff payments with a perspective to 'save towards' future repair works.

Photo credit: LeFil Consulting

5.k. Changes in employment and payment of local staff

The pilot strived to employ on average 1 pump operator, 1.82 kiosk attendants and 0.25 guards per scheme. The average monthly cost of salaries was expected to amount to KES 4,779 and be covered entirely by tariff payment.

By the end of the pilot, the total payments done towards local staff's salaries amounted to KES 279,932, meaning that only 8% of all salary costs were covered. However, cumulatively, across schemes, communities collected 2.19x the amount of salaries actually paid. There are 2 main reasons for this: Firstly, salaries were only paid when the community had accumulated enough money to pay all staff in a given month. Secondly, while we had initially envisaged to cross subsidize payments among the communities in the pilot, we decided against it, given the wide variations in tariff payment rates, and the overall low commitment of communities (i.e. it could have 'encouraged' free-riding behavior, at the expense of more committed communities)[14].

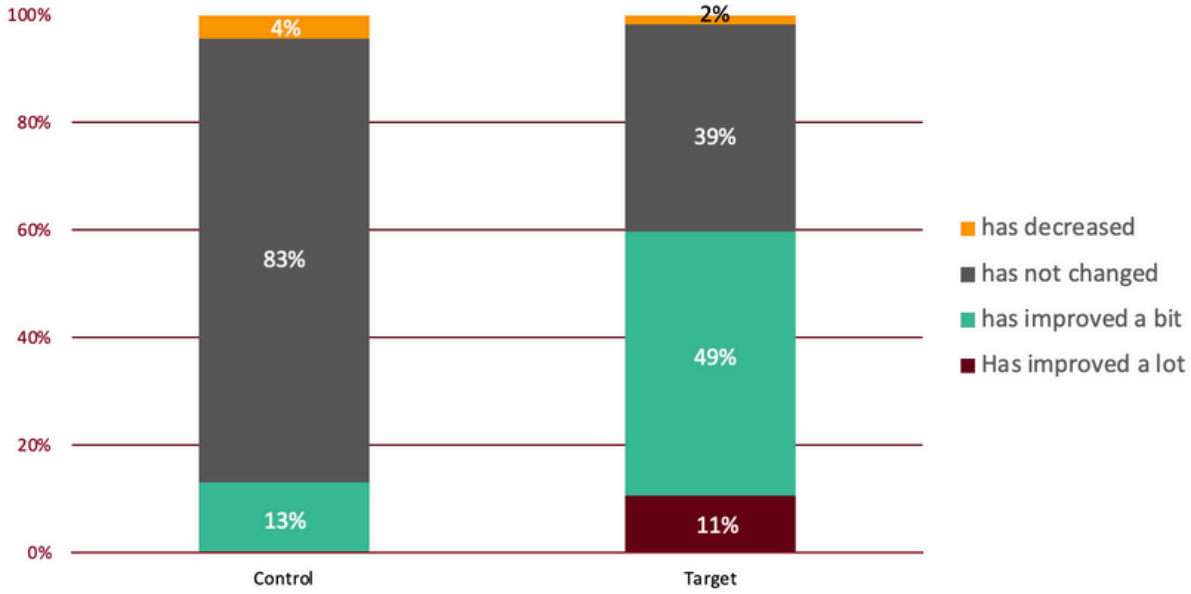
Regarding women's occupation, pump operators and guards' positions were covered fully by men whereas kiosk attendant's positions were covered by women in 54% of the cases. Also, control group communities declared having paid KES 902,200 to local field staff, which is 8.35 times more than target group (per scheme). However, this claim was never verified and might not reflect reality.

[14] At the end of the program, the WUC was informed of their corresponding positive balance and they were asked to choose a member (within the WUC) to receive the balance money. WUCs were also asked to confirm money reception. LeFil managed the money flows and the coordination with the communities.

5.I. Changes in capabilities of WUC chairman and pump operator

By the end of the pilot, the majority of WUC Chairmen in the target group felt that their ability to respond to water issues for their communities had improved, while only a minority of chairmen in the control group felt so.

Change in Chairmen's ability to protect their communities – control vs target group



By the end of the pilot, the majority of pump operators in the target group felt an improvement in their capacity to manage the daily operations of the water schemes while only a minority of pump operators in the control group did so.

Change in pump operators' ability to manage the water scheme – control vs target group

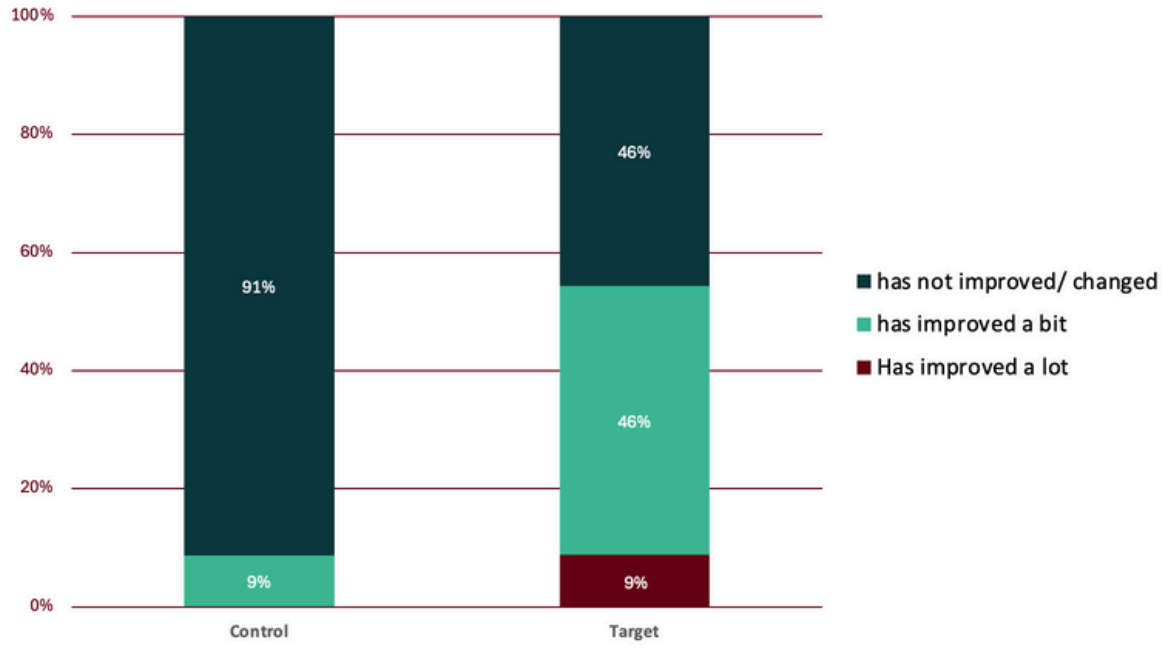


Photo credit: LeFil Consulting

5.m. Digitalization of tariff payments

At the beginning of the pilot, 35% of households reportedly had a mobile phone and only 51% of schemes had an M-PESA agent nearby. Thanks to the pilot, 89% of schemes used M-PESA at least once throughout the pilot in order to pay tariffs. Furthermore, several communities have communicated the desire of continuing using an M-PESA pay bill to manage tariff collection. Such communities have been advised on how to open a new M-PESA pay bill, including all the substantial paperwork that Safaricom requests for such procedure. It is still to be seen how many communities will manage to do so successfully.

5.n. Water schemes database

A "by-product" of the pilot was the unprecedented level of data generated and analyzed regarding the 60 target schemes. Thanks to the pilot, we went from a situation where absolutely no one knew what infrastructure was present, where and in which condition, to a situation where we had the infrastructure precisely mapped, including its condition and the repairs/ investments needed[15]. We also had 60 WUCs and local teams 'on call', able to communicate issues and demands directly. Having this information readily available significantly increased the level of speed, reactiveness, transparency and strategic budget allocation in case of droughts and emergencies. This was in fact used by Oxfam to deploy emergency relief funding much more effectively than any other mechanism put in place so far. One could also imagine that the TCG could use (in future) this information to guide its own investments and intervention decisions in the corresponding geographic areas.

15 This level of data/ intelligence regarding the water schemes is much higher than e.g. sensor-based maps. The latter essentially are equivalent the hotline mechanism we had instituted in the pilot whereby the communities would escalate issues to the pilot team (operator and LeFil). However, most sensor-based maps do not provide a sense of what the actual problem is, its severity and how best address it. Furthermore, these sensors are not always operational, are costly to install and maintain/ operate, and are mostly deployed in larger, internet-connected, more urban communities (vs. the last-mile rural schemes which we focused on).

6. FINANCIAL SUSTAINABILITY OVERVIEW IN TARGET AND CONTROL SCHEMES

6.a. Target group [16]

One of the main purposes of the pilot was to test and prove the "business case" for such an intervention (i.e. is it financially viable, how/how much does it make economic sense), including an assessment of savings stemming from the better and longer preservation of water infrastructure. We also wanted to estimate the actual level of subsidy required for replication or scale-up.

Overall, the program costed KES 30,892,828.[17] This amount includes the cost of the O&M service provision (paid by donors and TCG), representing 99% of the total cost, and the local operational costs (staff and fuel), representing 1% of the total cost. The cost of the O&M service provision was split between the cost of the curative quotes (71%), preventative works (11%), and overhead (10%), among others. The costs of the program would increase if there would have been enough funding to reconstruct the schemes that fell in severe non-functionality; repairs for those would have amounted to an estimated KES 2,541,667 additional. Of note, this total does not take into account the management, coordination and oversight activities performed by Oxfam and LeFil for this pilot. It would however be important to flag that, unless and until the O&M service provider's capabilities increase significantly, there will be a need for continuous and extensive hand-holding to make such an intervention a success, would it be replicated. In our assessment, this role could not be played (yet) by the TCG either, in light of the composition of the team overseeing water infrastructure in rural areas, and the resources at their disposal.

To pay for these costs, the WUCs managed to collect KES 645,725 in tariff payments[18]. This source of revenue was uniquely dedicated to cover local operational costs (local salaries, fuel for generator, etc.) which amounted to KES 335,718[19] (while the rest was accumulated as savings).

16 For comparison purposes, all costs mentioned in this section have been extrapolated to 60 schemes.

17 This amount excludes the costs incurred for water schemes which were off-boarded from the pilot (as the infrastructure needed full reconstruction), donors 'visits, and Grundfos-related activities. However, it takes into account the operator's penalties (which were deducted from the total). That is, had the pilot not implemented penalties, curative costs would increase by KES 92,376.

18 In the graph below, this amount is left at KES 335,718, matching the local costs covered. Indeed, it is reasonable to assume that local costs and tariff collection will be a 0 sum game sum. That is, all money collected is going to be spent in local costs, and cannot be sufficient to be contributing to the O&M expenses. Hence, no matter how much tariff is collected, it can only be spent on local expenditures (and cover them fully, or not).

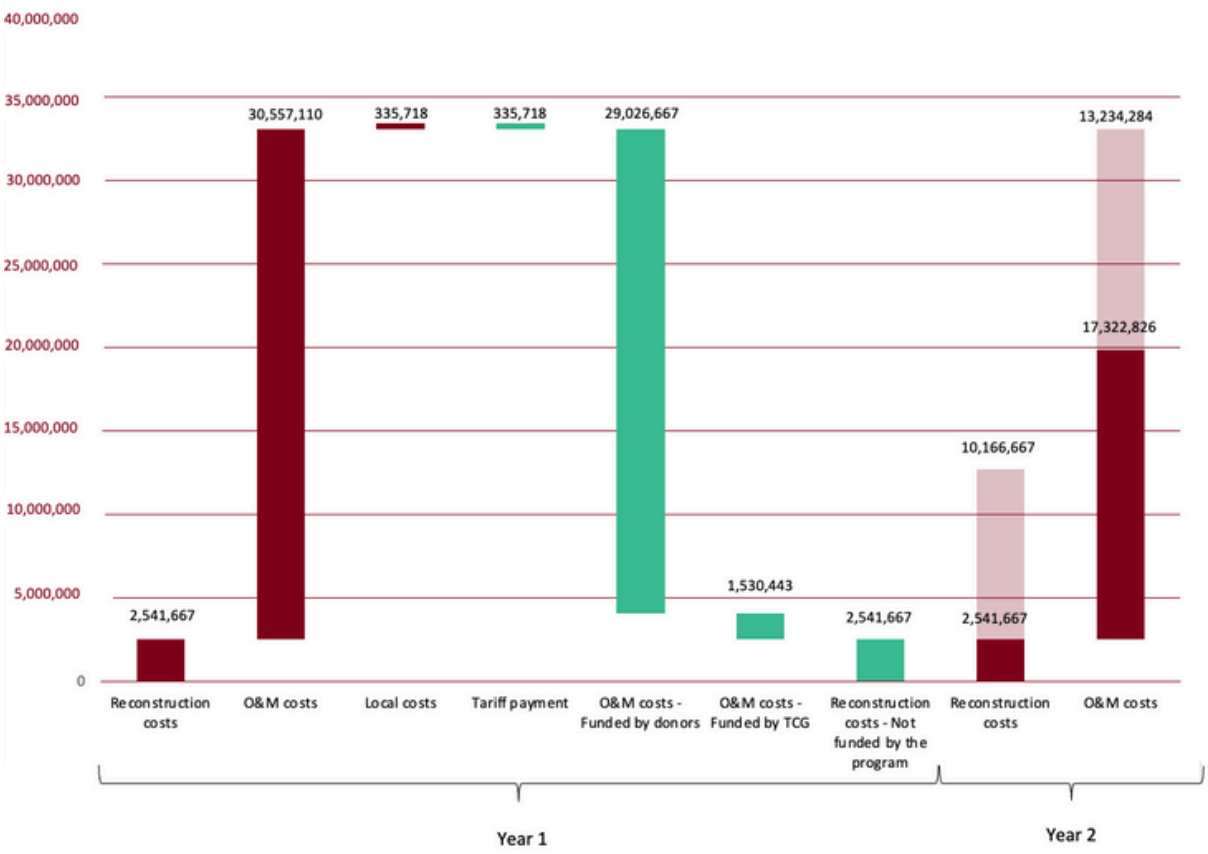
19 Local costs covered are lower than the amount of tariff collected because the program did not apply cross-subsidization. That means that while some (very few) schemes collected more tariff than necessary to cover all local operational expenses, a vast majority of others did not do so. Hence, for the ones that fell short, local salaries were simply not paid (and the little tariff kept accumulating until it would be enough to perform a full monthly payment for all the staff).

More importantly, the pilot helped generate significant savings by slowing down water scheme's deterioration rate, which were estimated at KES 10,166,667. It also helped generate savings on the O&M costs by reducing the need of curative repairs throughout the pilot (decrease of 61% from the first half of the pilot to the second half). For this reason, it is expected that in the second year, the cost of curative costs would be further reduced by 61%, thus reducing the overall O&M costs significantly. These savings are clearly the biggest monetary benefit of the program.

In light of the above, the annual funding requirement to continue implementing the pilot with similar characteristics would add up to KES 19,864,493 per year, as of year two.
The graph below portrays the costs (red columns) and funding (green columns) required to run a similar pilot. During the first year, total costs amounted to KES 33,434,495, including reconstruction, O&M and local costs. These costs were funded by communities through tariff payment, donors and the TCG. Reconstruction costs were not funded by the program. During the second year, reconstruction and O&M costs are predicted to amount to KES 19,864,493.

Finally, the pilot avoided 4 schemes to fall into non-functionality, thus creating 'reconstruction' savings of KES 10,166,667, and helped bring the intensity of other repairs down by KES 13,234,284 (shaded red columns).

Overview of costs[20], revenues, savings and funding requirement for the following year for 60 water schemes with characteristics similar to our target group (KES)



20 The cost of reconstruction was not covered by the pilot.

Another objective of the pilot was to assess the feasibility of possible funding mechanisms to pay for the financial gap (i.e. the funding requirement above). Our recommendation for the TCG was to institute an O&M tax. This tax would be levied by the TCG with any organization (be it the government itself or a donor) that pays for new water infrastructure (or replaces one that fell into disrepair) in order to cover the O&M needs that arise over this new infrastructure's lifespan. The idea is that O&M provisioning should be considered an integral part of Capex investments, and that donors/payers should have an intrinsic motivation in installing infrastructure that lasts as long as possible (i.e. invest into better design, stronger quality control, etc.). Based on the results of the pilot, it appears that, assuming that 60 schemes are (re)constructed every year in Turkana at an average cost of KES 2,541,667, the O&M tax would need to amount to 18% of total capex invested (in year 1).

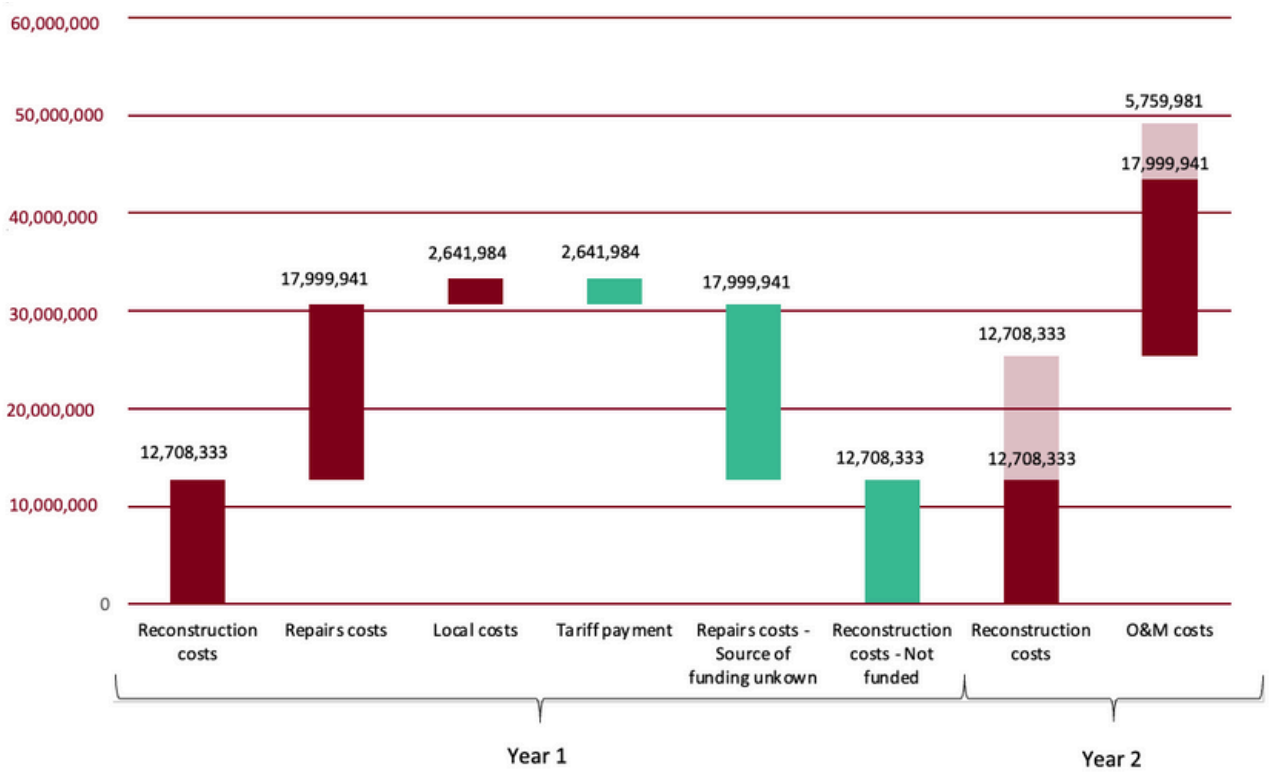
6.b. Control group[21]

For the control group, we extrapolate that the funding required for repairing major breakdowns for 60 schemes, and reconstructing the schemes that fell in non-functionality in the first year, without investing in O&M as in the target group, would amount to KES 33,359,258. This amount is slightly less than what the pilot spent on the 60 target schemes in year 1, but this number hides the fact that 400% more money would be spent on reconstruction, and 41% less in maintenance repairs (compared to the split of expenses in the target group). The difference however becomes striking in year 2, as the repair costs keep increasing and the rehabilitation costs sky-rocket, while they diminish overall in the target group. This stems from the fact that the control group schemes spent significantly less in curative works and would have to incur significantly more costs to reconstruct dysfunctional schemes and address pending curative needs. The 'paying little – fixing little' approach hides the hidden costs of unperformed repairs: as communities only fix water infrastructure when it is critically damaged and postpone the minor repairs, the accumulation of the latter ultimately leads to a faster deterioration of the infrastructure.
Last but not least, the pilot delivered a number of non-monetary benefits (see section 5 above) among target schemes, which were not realized in the control group and which are not quantified here.

21 For comparability sake, all costs mentioned in this section have been extrapolated to 60 schemes.

The graph below portrays the costs[22] (red columns) and funding/ payments[23] (green columns) required for 60 non-O&M-serviced water schemes. During the first year, the costs were funded by communities through tariff payment and unknown funders. No reconstruction was undertaken. During the second year, reconstruction and O&M costs are predicted to amount to KES 49,176,589. This includes: the costs to reconstruct the schemes that fell in non-functionality the first year and the second year (shaded red)[24], as well as the costs to repair an increasing number of partially functional schemes (shaded red)[25].

Overview of costs, revenues, savings and gap funding requirement for 60 water schemes with characteristics similar to our control group (KES)



22 Of note, the WUCs in the control group report higher local staff and operational costs than in the target group. However, this is likely due to the fact that local staff's salaries were self-reported, and may not reflect actual payments made. In the graph below, this amount is left at KES 2,641,984, matching the local costs covered. That is, we assume that local costs and tariff collection will be a 0-sum game; and all money collected is going to be spent in local costs, and cannot be sufficient to be contributing to other expenses.

23 Of note, the control group reportedly managed to collect proportionally more tariff. Whether this claim is true remains to be proven.

24 It is assumed that the same number of schemes would fall into non-functionality in the second year, given that there is no O&M in place.

25 It is assumed that the costs of repair will increase at the same rate as the proportion of partially-functional schemes increased over the duration of the pilot (i.e. 32%).

7. LESSONS LEARNED

7.a. Abilities, roles and responsibilities of key stakeholders

Oxfam deployed a strong project management team, who was able to raise funds for the pilot and to conduct efficient onboarding meetings for WUC members. Despite this, not all WUCs which were on-boarded were well-established, functional or fully aware. As a result, significant in-field, scheme-by-scheme follow-up was required. In addition, it would have been beneficial to have a technical resource engaged from beginning to end, for the review of the quotes and verification of the works.

Due to the increasing complexity of the pilot, the limited capabilities of the service operator, the difficulties in using M-PESA for the needs of the pilot, the need to regularly engage with the WUCs and communities, LeFil ended up taking a much more extensive operational role than expected.

The TCG intervened successfully when there were challenges with the communities. It also provided some information that served as a starting point for the identification of schemes. However, the lack of (timely) funding resulted in the county's not fulfilling its commitment in terms of investments and repairs.

Epicenter was selected as the service operator, out of a list of 3 qualified candidates, out of which the 2nd bided only on O&M services for extraction infrastructure (excluding distribution infrastructure), at a much higher price, while the 3rd bided for an exponentially larger budget. One can therefore conclude there is a lack of established service providers interested and able to provide O&M services at scale in Turkana and possibly more broadly.

Despite our expectations and incentives provided (e.g. separate, guaranteed payment for local overhead), Epicenter's investment into the pilot was deemed low, albeit we trust that they learned a lot from this pilot too. For instance, it did not invest into a strong local operation in Turkana (but rather brought in their own Nairobi staff on a temporary basis, who had no local language abilities or knowledge), set up an office very late (without proper infrastructure or spares' stock, which it kept ordering and bring from Nairobi on an as-needed basis), did not invest into building working relationships with most local operators, nor invested into tools that would allow it to manage a large O&M operation proactively, reliably, transparently and which sufficient quality controls.

7.b. Identification and state of water infrastructure

Identifying schemes for the pilot took longer than expected despite asking different stakeholders to support us with this information: neither the TCG nor various donors/NGOs would know the location of the schemes they had financed, nor the type of infrastructure installed and when, let alone the probable level of functionality.

Also, at the onset, it was difficult to find functioning schemes that fulfilled the pilot's requirement for basic functionality. Most of the schemes listed by TCG were in poor or very poor condition. And even among the better functioning schemes that were selected, l5% already required repairs by the time that the team was deployed on the ground. This created an unexpected level of backlog at the very start of the pilot, which drove a higher spend than anticipated, and increased pressure on delivery. As a result, the SteerCo had to evolve the rules as what repairs could be financed (or not). These essentially consisted in: only do strictly necessary work to improve the performance and/or resilience of the system; no investment into replacing infrastructure unless absolutely necessary for reliable access and provision to the local communities; no expansion of infrastructure; off-boarding of schemes for which the rehabilitation budget was too high.

7.c. Implementation

A number of implementation shortcomings were experienced, which should be better addressed upfront in possible future iterations of such interventions:

- The baseline data collected by external consultants was found unreliable and incomplete.
- The tools and processes available with the service operator to manage and oversee the operation were insufficient and inadequate. This resulted in LeFil's developing ad hoc tools, documentation and processes, while the operator struggled to use consistently and reliably.
- In terms of the approval process for the curative quotes, the quantity, size, and complexity of the quotes were higher than anticipated, which resulted in the operator being unable to provide quality-controlled documentation on time, which led to a backlog compounded by the back-and-forth needed to finalize and approve the quotes in a satisfactory fashion.
- Given there was no management/ oversight resource deployed locally, the operator failed to ensure strong quality controls on the ground, and overall reactiveness was low. As a result, Oxfam decided to conduct an exhaustive verification of all sites and works performed, which put into light a number of performance, quality, billing and reporting issues.
- The service operator struggled to evolve its financial processes to the logic of an O&M operation (as opposed to one-time construction works). As a result, LeFil had to take a highly proactive role to ensure financial management and oversight; and multiple payments to the operator were delayed (as extensive corrections and clarifications were needed).

- The penalty system did not incentivize the operator to perform as per pre-agreed targets. Instead, the operator continuously claimed exceptional management of penalties (after repeatedly failing to reach targets), which Oxfam mostly granted, undermining further any commitment to work towards improving delivery.

7.d. Digitalization of tariff collection and disbursement

A number of challenges were encountered in the digitalization of tariff collection and disbursement, including:

- 65% of users did not have mobile phones. This was addressed by organizing a separate sim for the Treasurer, who would then perform payment operations on behalf of the users
- 49% did not have an M-PESA agent in the village. This was addressed by having the Treasurer keeping the payments in cash, and going to deposit it on a regular basis in the closest M-PESA point
- The requirements of Safaricom for the opening, management, auditing, access of the accounts was not suited to our needs. Hence, we had to set up a complex structure of mother and subaccounts, which ended up managed by LeFil
- While the collection of the money was complex, the return of the unspent money was even more complicated, as M-PESA systems do not ensure automated tracking of the source of payments, nor of reversals

7.e. Governance

The SteerCo consisted of Oxfam, LeFil and Epicenter and it met weekly for the full duration of the pilot. The local TCG team was involved on an as-needed, in person basis (a dedicated person had to be hired to manage interactions with TCG and communities). Higher TCG authorities were only updated and involved at limited intervals.

This set-up allowed for the required, extensive amount of coordination, adaptability, flexibility, and reactiveness. However, one may question whether this set-up is sustainable or even appropriate in the long-term, and at which point in time an operator would be able to operate more independently.

8. CONCLUSIONS AND RECOMMENDED WAY FORWARD

This pilot has costed money: first, the service provider charged not only the quotes, but also for the overhead related to setting up an operation in Turkana; second, we had to deal with a worse and fast deteriorating state of the infrastructure from the beginning. However, despite the large cost, the pilot has delivered a significant monetary and non-monetary benefits: on the monetary side, we can now prove that better maintaining water schemes over time creates important savings in terms of reconstruction costs (these savings represent 30% of the total amount invested in the pilot by donors and TCG); Regarding the non-monetary benefits, the pilot has prevented schemes to fall into total disrepairs by performing maintenance works and 15x more curative works than control; improved capacity of the chairmen, treasurers and pump operators in water management, tariff collection and maintenance; generate unprecedented information on schemes location and functionality which can be used to guide the TCG's own investments and intervention decisions in the future; deliver better performing, more reliable, accessible and secure infrastructure; improve the water quality[26]; as well as raise interest in digitalizing the tariff collection procedure.

We also experienced unexpected developments during the implementation, which should be taken into account in future iterations of similar interventions. On the negative side:

a) Communities did not show a high level of engagement with the pilot, if anything the pilot reinforced free-riding behavior/ feelings of entitlement towards donor-funded interventions. This is an aspect that should be further understood, as low community engagement would have negative consequences in the long-term for the overall success of such schemes. The claims of the control groups (in terms of satisfaction and tariff payment) should also be verified.

b) The service provider did not invest the expected assets, time and resource to establish a strong local operation; and did not significantly rethink and adjust its tools and processes to meet the specific needs of a year-long operation focusing on O&M (rather than the usual construction business). This is a problematic aspect to address in future, as there are possibly not so many alternative service providers around.

c) The management of the pilot proved very complex to handle, including for instance the intricate management of community dynamics, the rigidity and bureaucracy linked to Safaricom requirements for the paybills; and the problems and delays created by the lower than-expected performance of the service provider. This was and should be addressed by putting a strong, hands-on management team in place, to oversee the roll-out of such interventions. However, this will also add significantly to the cost.

[26] Albeit the pilot did not finance the water quality interventions directly, it was thanks to the pilot that Oxfam could map the schemes with significant water quality issues, and find funding to remedy to this situation

On the positive side, a powerful development was that the pilot proved extremely worthwhile during the repeated drought emergency responses: To date, the main response mechanism involves putting different organizations together to try drive the coherent and informed deployment of resources. It appears that this mechanism is slow and partly inefficient and ineffective. In contrast, thanks to the pilot, we knew exactly which schemes were most affected, in which way, and had an implementation arm ready to be deployed quickly where needed.

In conclusion, we believe that, despite some of the shortcomings, the pilot is better than the 'spend little – get little' status quo since the latter leads to schemes falling into non-functionality much quicker over time (driving important costs but also worse outcomes for the communities). However, if replicated in future, we believe that thorough consideration should be given to the issues and pitfalls we encountered during the design and implementation phases.


Photo credit: LeFil Consulting

ACKNOWLEDGEMENTS

This paper is the result of a co-development partnership to pilot a market-based approach to manage operations and maintenance of rural water schemes arid zones of Kenya by Oxfam and LeFil Consulting. For this pilot, Oxfam led a consortium which included the Turkana County Government (TCG), LeFil Consulting, the private water company Epicenter Africa, and Grundfos Kenya Pty.
The pilot was funded by Oxfam, LeFil Consulting, the TCG, Partnering for Green Growth (P4G), the Waterloo Foundation, the Swiss Agency for Development and Cooperation (SDC) and the German Federal Foreign Office (GFFO).

ABOUT

LeFil Consulting is a mission-driven consultancy specializing in the identification, design, growth, and replication of innovations that create social and economic value sustainably and at scale. Founded in 2010 and based in Zurich, Switzerland, LeFil works globally with start-ups, large corporations, donors, NGOs, and governments. Leveraging rigorous business methodologies and extensive first-hand data collection, LeFil aims to solve social problems in cost-effective, innovative, and focused ways. Its projects span diverse sectors, including housing, energy, water, sanitation, financial services, health, and agriculture, making substantial impacts in communities worldwide.

Oxfam is an international organization dedicated to fighting inequality to end poverty and injustice. From its beginnings in 1942 as the Oxford Committee for Famine Relief, it has grown into a confederation of 21 independent charitable organizations working together in 70 countries around the world. Oxfam's mission is to provide lifesaving support in times of crisis, to advocate for economic justice, and to promote gender equality and climate action. Together with local organizations and communities, Oxfam strives to create lasting solutions and empower people to build better lives. The organization emphasizes a feminist approach in its analysis and actions, ensuring that women's rights remain central to its efforts.