10 problems with the *PlayPump*

The *PlayPump* is a water pump mechanically powered by the rotation of a children's playground roundabout, which pumps water to an elevated water tank, bearing advertising billboards. The income from renting its billboards for commercial and public service advertising is intended to pay for the maintenance of the *PlayPump*. First installed in South Africa in 1994, the project started to receive international attention after it won the World Bank Development Marketplace Award in 2000. Global press coverage and funding for the project increased especially after 2006, when the project received the backing of the Case Foundation in the United States, who set up the organization PlayPumps International to campaign on its behalf. But in 2009 negative reports about the *PlayPump* began to emerge, leading to the loss of most international support for the project.

On the following pages ten main faults with the *PlayPump* system identified by these reports are presented in detail. These pages are extracted from Ralph Borland's PhD thesis 'Radical Plumbers and *PlayPumps* – Objects in development' (2011), Chapter 7, p. 168 – 182. Works cited in this extract are listed at the end of this document.

For more information see http://www.objectsindevelopment.net

7.4 Ten faults identified in the *PlayPump* system

In this section, evidence from sources of information about the *PlayPump's* performance in the field, as introduced earlier, are used to build on the suspicions just recorded. This account starts with the difference between the advertised performance of the system's pump and its actual performance in the field, as that affects other calculations below and impacts on other flaws in the system. The ten points below list the main faults identified in the *PlayPump* from reports and studies in the field; there are still more flaws in the detailed operation of the pump, or in consequence of these below, which will be revealed at other points in this chapter.

1. The pump does not perform at the rate advertised

Firstly, reports from the field identified *PlayPump* installations that did not pump at the rate claimed by its manufacturers. UNICEF, for example, found that "in Mozambique some stakeholders reported that it takes approximately 4 hours of continuous pumping to fill the 2,500 liter reservoir tank" (2007, p.8). This means that this particular installation pumped water at around 625 litres per hour, rather than 1,400 litres per hour.

There would be, as we know from our investigation of the Zimbabwe Bush Pump, variation in the performance of any pump – though this variation is not documented by Roundabout Outdoor or PlayPumps International. UNICEF notes that for the *PlayPump* too, "the ease of operation… may be influenced by the depth to the dynamic water level and installation details" (UNICEF 2007, p.9); and Erpf points out that "how much water a PlayPump is able to draw is mainly depending on the physical condition of the pump operators (age of children) and on the daily operation time" (Obiols & Erpf 2008, p.33).

But both UNICEF's and SKAT's reports draw attention to a mechanical limit which restricts its performance of any *PlayPump*. Because of the configuration of the pump head, restricted by its containment within the roundabout, the *PlayPump* has a very short pumping stroke (the up and down travel of the mechanism that lift water up the borehole). The roundabout uses an unusual interior mechanism to drive the pump (see fig 7.3 below), whereby the circular movement of the roundabout raises and drops the pump valve twice on every rotation, pushing it along two curved tracks within the roundabout, rather than using the lever action of a conventional handpump. As a result, the pump stroke for the *PlayPump* is on average about 6.5 cm, compared to 22cm on the AfriDev, for example, Mozambique's national standard handpump (Obiols & Erpf 2008). As the *PlayPump* operates on the same boreholes as handpumps, using a similar range of cylinder sizes, this means it must pump less water per stroke than a conventional handpump.

Fig 7.3: The interior of the *PlayPump's* headgear, left (Obiols & Erpf 2008, p.21); and the Zimbabwe Bush Pump's headgear, showing the much longer travel of the pump mechanism, right (arrows and text added).

Erpf calculates in his report the maximum theoretical pumping rate of a *PlayPump*, using a simple formula: he calculated the amount of water pumped on each stroke according to the cylindrical volume of water displaced, multiplied by the number of rotations per minute, multiplied by 2 as there are two pump strokes per rotation of the roundabout. For a *PlayPump*

using a 50mm diameter cylinder, the same size as the smallest diameter Zimbabwe Bush Pump and AfriDev handpump – more about the range of diameters of *PlayPumps* follows – this is calculated below. Erpf used 20 rotations of the roundabout per minute as his measure, rather than the 16 on which Roundabout Outdoor's claim is based; this will be corrected for shortly:

> Calculation of projected cylinder area: d2 x π/4 or 52 x 3.1416 /4 = 19.63 cm2
>
> Calculation of discharge/stroke: 19.63 cm2 x 6.5 cm = 127.59 cm3 = 0.128 litres
>
> Discharge per minute (20 RPM) 2 x 20 strokes x 0.128 litres = 5.12 litres
>
> Discharge per hour 60 x 5.12 litres = 307.2 litres
>
> (Obiols & Erpf 2008, p.33)

So at 20 rotations per minute, a *PlayPump* with a 50mm diameter cylinder pumps a maximum of 307.2 litres per hour, in ideal conditions. The manufacturer's claim is based on 16 rotations per minute; if we use Erpf's formula, but for 16 rotations per minute instead of 20, we arrive at only 245.8 litres per hour. This is for the smallest cylinder; there are two larger sizes of cylinder used by *PlayPumps* (the size of cylinder varies according to the size of the borehole the pump is installed on): using Erpf's formula, the 80mm diameter, which is the largest size cylinder used in Mozambique (Obiols & Erpf 2008, p.25) could pump a maximum of 627.8 litres per hour at 16 rotations per minute, and the 100mm diameter cylinder, used only on shallow wells in South Africa (ibid), 979.2 litres per hour at 16 rotations per minute. Rather than 1,400 litres per hour, we have a range from roughly 250 litres per hour to 980 litres per hour, as absolute maximum, ideal values; and in Mozambique, no more than 630 litres per hour, as the largest cylinder used in that country is 80mm.

Erpf compares the *PlayPump's* performance to the 50mm diameter AfriDev handpump, which can pump a theoretical maximum of 845 litres per hour at the same rate of pump strokes (Obiols & Erpf 2008); and the 50mm diameter Zimbabwe Bush Pump on the shallowest borehole can pump 1,300 litres per hour at 75 W input power (pump strokes per hour not noted) (Erpf 1998). This is against less than 250 litres per hour for the same sized *PlayPump*.

∅ mm diameter	PlayPump	AfriDev	ZBP B-type
50mm	245 lph	845 lph	1,300 lph

Fig 7.4: Maximum pumping rates for the 3 pump types, 50mm cylinder, 16 rotations (or 32 strokes) per minute

If it seemed strange that the *PlayPump* could drive a conventional borehole pump to produce water at almost double the rate of the Zimbabwe Bush Pump – it is strange, because untrue. Both the AfriDev and the Zimbabwe Bush Pump in fact far outperform the *PlayPump*, pumping 3 to 5 times as fast.

2. It fails to meet recognised standards for minimum water supply

This is mainly because the amount of people the *PlayPump* can serve is oversold; and so it is placed in communities far larger than it can supply. We have already calculated that it would be impossible for the *PlayPump* to supply people in South African with their 25 litres daily minimum, if it is intended to serve 2,500 people; at 10 hours a day it could only supply a fifth of their needs. Chambers in his article in the Guardian, identifying the *PlayPump* system as "based on flawed water demand calculations", performs a calculation based on a similar principle: he works out how much water a *PlayPump* would need to pump to supply the daily water needs of 2,500 people, based on a minimum daily water requirement of 15 litres per day, from the Sphere Project, who tabulate requirements for disaster relief (Chambers 2009). Based on the pumps advertised capability of 1,400 litres per hour, this would "require children to be "playing" non-stop for 27 hours in every day" (ibid).

"Under more reasonable assumptions", Chambers continues, "a Playpump could theoretically provide the bare minimum water requirements for about 200 people a day based on two hours' constant "play" every day" (ibid). From observations in the field, and from Erpf's calculations of its maximum pumping rate, we know that the system is even less capable of meeting this requirement than Chambers estimates; but his calculations show that even without first-hand information about the *PlayPump's* performance, its claims can be easily undermined using available evidence about standards for water provision, against the manufacturer's claims.

Erpf states several times in his report to the Mozambique government his concern that the *PlayPump* contravenes Mozambique's national water policy, which requires any means of water provision to supply at least 20 litres per person per day (Obiols & Erpf 2008). Using his revised figures for a more realistic, though still idealized output from the *PlayPump*, he calculated the following estimates for the maximum amount of people it could supply. If the pump is installed in a primary school, he concedes that 5 litres per child per day should be enough for drinking water and hand-washing only, while at school; if the *PlayPump* was used for 6 hours per day, then around 940 students can be served with this amount. If the pump is shared between a primary school and a community, then he calculates that if adults used the

PlayPump for the remaining 6 hours in a day, getting 20 litres each, then an additional 235 beneficiaries could be served. And if the *PlayPump* is installed in a community, not a school, then "the users could theoretically operate the pump for the whole day (12 hours) without interruption. Under such circumstances maximal 470 beneficiaries (2 x 235) could be served [with 20 litres each], far less than the 2'500 claimed in the advertisement" (Obiols & Erpf 2008, p.30).

Erpf's assumption that the *PlayPump's* roundabout could be in operation for 12 hours a day is both generous, in terms of increasing his estimate for the amount of people the *PlayPump* could realistically serve – Chambers, after all, thinks 2 hours a day of 'play' is a reasonable expectation – and realistic, in that the estimate is based on Erpf's knowledge that where the *PlayPump* is the primary source of water, people might have to operate it for up to 12 hours a day. "According to the comments of water users, a PlayPump is in use between 6 to 12 hours per day" (Obiols & Erpf 2008, p.36). But the *PlayPump's* roundabout is not in motion for this many hours a day through play, and neither Erpf nor UNICEF in their report make any pretence that this is the case.

3. Children's play is not the main source of input to the pump

Both UNICEF's and SKAT's reports observe that adults are frequent users of the *PlayPump*. Because both the pumping rate of the system and the number of people it can supply are exaggerated several-fold, children's play cannot produce enough water to meet the needs of the community, and so adults – uniformly women – must operate the *PlayPump's* roundabout. They do this by standing next to the roundabout and turning it by hand (Obiols & Erpf 2008).

In fact, adults and children are sometimes in competition for the *PlayPump*, not as plaything, but as vital means of access to water. "In hot weather with sunshine, it is unpleasant to operate the pump during the time between late morning to early afternoon. Early morning and late afternoon is also the time when the adults want to fetch water. During this time they don't like if their hard work of drawing water is interrupted by playing children" (Obiols & Erpf 2008, p.25). When the *PlayPump* is shared between a school and a community, this competition is more pronounced. "Depending on the size of the school and the number of hours the PlayPump is occupied by the children, not much time is left for the community to draw water for serving a large user group. Communities in need of getting water are therefore not happy when being interrupted by children in their daily task" (Obiols & Erpf 2008, p.30).

Fig 7.5: Women turning the *PlayPump's* roundabout by hand, from SKAT's report in Mozambique (2008)

This is predictable; David Martin of WaterAid warns that although the *PlayPump* "seems like a good use of children's high spirits, these may not be available at times of water demand, early morning and early evening and if the weather is wet" (2009, p.1). While the system's water tank is meant to lessen this problem by enabling water to be stored over times when children are not playing, because of the pressures on the system the water tank is almost never full.

4. The roundabout is painful and undignified for adults to use

Out of 26 pump installations surveyed by SKAT in Mozambique, to the question 'Pump operation liked by the community?' all adults responded 'no' (Obiols & Erpf 2008, p.72). UNICEF too found that in Zambia "many users reported that their pumps were hard to operate," and that all women interviewed in that country said they did not like using the pump (2007, p.9). The *PlayPump's* roundabout is designed for children to use; at around 60cm off the ground, it is the right height for this use. But it is too low to be comfortable for adults to use, who have to bend over to turn it. At 15 out of the 26 locations surveyed by SKAT, adults said the roundabout gave them a sore back (Obiols & Erpf 2008). A woman in Mozambique told Amy Costello, "From 5 a.m., we are in the fields, working for 6 hours. Then we come to this pump and have to turn it. From this, your arms start to hurt. The old handpump was much easier" (Costello 2010c).

In addition to the awkward height of the roundabout, the wheel is also difficult to turn because there is resistance to be overcome twice on each turn of the roundabout's wheel, as the pump mechanism is lifted (Obiols & Erpf 2008). While the first-world audience for the *PlayPump* might assume from its publicity that the wheel turns with the ease of a conventional roundabout in a playground, this is not the case. "Some primary school children complained of becoming tired very quickly after pushing the pump, particularly as additional torque is

required with each rotation to commence the upstroke of the piston" (UNICEF, p.8). Especially without weight on the roundabout – adults do not want to sit on it like children – there is little momentum to overcome this resistance when it is turned by an adult.

A young woman in Mozambique demonstrated to Costello how she could jump onto the *PlayPump's* roundabout and push it around, but, she said, indicating women sitting nearby "These old women wouldn't do it like this" (Costello 2010c). SKAT's report from Mozambique confirms that both elderly people and heavily pregnant women were not able to move the roundabout's wheel (Obiols & Erpf 2008).

It is not just the physical discomfit that prevents some women, such as the elderly, from using the pump: some women said that they felt embarrassed to be seen operating the roundabout, especially "where the people watching them did not know the linkage between the 'merry-go-round' and the water pumping", for example where the pump is near a public road (UNICEF 2007, p.10). The *PlayPump's* roundabout is both physically and psychologically discomfiting to its adult users.

5. The water tank is a hindrance to users

As there is unlikely ever to be excess water pumped by the *PlayPump*, as the pressures on the system outweigh its capabilities, the water tank is unlikely ever to be filled. "Not one single water tank was found by the mission that was used for storing excessive water from pump operation", reported SKAT's study in Mozambique (Obiols & Erpf 2008, p.34). "The users were all pumping only just as much to fill their own canisters and the small amount of water that children were able to pump was immediately used for drinking purposes" (ibid). "All user communities visited reported that the reservoir tank is never completely full", reported UNICEF, "and 75% of communities in Zambia and Mozambique reported that they only operate the Playpump® to directly fill water containers, i.e. the tank never stores any excess quantity of water" (UNICEF 2007, p. 9).

UNICEF's study states the problem that resulted: "This means excessive work is needed to raise the water to the elevated tank with no additional benefit accrued" (UNICEF 2007, p. 9). Looking at the diagram of the *PlayPump* system in Fig 7.6, overleaf, the problem can be observed: where a conventional hand-pump supplies water directly from the top of the borehole, the *PlayPump* pumps it first a distance of several metres horizontally from the roundabout-pump to the base of the elevated water tank, then up 7 metres to the tank – this vertical upwards distance is the most significant, working against gravity – down again, and

then several more metres across the ground to the faucet from where water can be drawn. When the tank is empty, the water has to be pumped across this whole distance every time.

Owen graphically describes the problem as he observed it in Malawi, where he saw a lone woman operating the *PlayPump's* roundabout, "locked in a full body struggle getting the wheel to spin" (Owen 2009b).

> With every rotation I could hear a small splash of water in the tank (about 20ft above), followed by a splash of water into the lady's bucket on the ground beside us. Because the tank wasn't full (which I figure they almost never are), the lady was essentially having to exert herself to move the water 20ft upwards, just to have it come back down again. I don't know what you think, but to me it seemed like a bit of unnecessary extra effort to fill a bucket (ibid).

Fig 7.6: The distance water has to travel from the borehole to the standpipe. Photograph by the author.

The other function of the water tower is to support the billboards whose rental is intended to generate income for maintenance; here too the system has not lived up to expectations.

6. Advertising on the billboards is not a secure source of revenue

The *PlayPump's* billboards are presented as a means of the project's 'sustainability', and a way for private companies, governments and organisations to reach a poor rural demographic. But, especially in more remote rural areas, far from busy roads – installations that are close to roads have fared better for advertising – the *PlayPump's* billboards are often blank. I have observed this myself on an informal tour of *PlayPump* installations in rural KwaZulu Natal, South Africa in 2010, where 8 out of 10 installations in the area surveyed had no billboard advertisements at all (see fig 7.7, next page).

PlayPumps International CEO Gary Edson acknowledged the lack of advertising uptake on the *PlayPump's* billboards in his '100 day' letter in September 2009, noting that "the global economic crisis took a toll on ad sales". UNICEF's and SKAT's reports found similar evidence in Zambia and Mozambique. "The majority of tanks outside South Africa did not carry advertisements", noted UNICEF (2007, p.15) "Public service messages were observed on approximately half of installed PlayPumps® only" (UNICEF 2007, p.10). In Zambia, "38% of PlayPump® water systems visited had tanks which were completely blank, and 75% carried no advertisements" (UNICEF 2007, p.12).

In SKAT's report, of 100 PlayPumps in Mozambique, only 22 had advertisements (Obiols & Erpf 2008). "The strategy of generating enough funds to cover the maintenance cost for 10 years", noted Erpf, "does not work in rural Mozambique. In such places, no potential clients can be reached with the advertisement on the billboards. Most billboards are therefore initially blank and according to Roundabout Outdoor… the pumps in Mozambique are cross-subsidized by South Africa and Zambia, in order to cover the costs for maintenance interventions" (Obiols & Erpf 2008, p.35). "It is claimed by Roundabout Outdoor that this model is making the water supply solution financially sustainable. This is clearly not the case in Mozambique" (Obiols & Erpf 2008, p.15). We can note in Roundabout Outdoor's response that they claim advertising in Zambia and South Africa will cross-subsidise Mozambique's installations: yet UNICEF documented hardly any more *PlayPumps* with adverts in Zambia, and my own tour of *PlayPumps* in South Africa, while informal, appeared to show the same problems there.

That the billboards are not a viable source of income for the maintenance of *PlayPumps* cannot have helped Roundabout Outdoor fulfil its guarantees to maintain them; though this is not the only reason why maintenance of *PlayPumps* has been a persistent problem.

Fig 7.7 *PlayPump* installations visited in KwaZulu Natal by the author in August 2010, with their Roundabout Outdoor tag numbers, where present/visible.

7. The maintenance system for the pumps is unsatisfactory

The downtime of *PlayPump* installations awaiting repair in Mozambique, SKAT's report states, has been "a real disaster" (Obiols & Erpf 2008, p.37). At the site where Costello interviewed women users in Mozambique, local users told her that the *PlayPump* had not produced any water in 6 months. "When women called or texted the repair line, they told me they got no response" (Costello 2010c). These women had to walk some distance instead to the next village to collect water.

There are numerous examples from UNICEF's and SKAT's studies, of *PlayPump* installations with faults requiring maintenance, which had not been attended to in some time. UNICEF reported that 25% of the *PlayPumps* they visited in Zambia needed some kind of repair, and noted that "a number of poor quality installations were observed… including pumps with concrete aprons that were heavily eroded only months after installation and pumps with leaking pipes… no remedial action had been taken to rectify the defective results of the poor quality workmanship" (UNICEF 2007, p.8).

"The downtime of some of the PlayPumps… is a real disaster for all stakeholders especially for the communities in need of water", noted Erpf in his report (Obiols & Erpf 2008, p.37). In Mozambique, the average downtime of faulty pumps that could be repaired, as surveyed by SKAT, was 60 days. "This is by far too long for the communities in need" (Obiols & Erpf 2008, p.26). Joaquim George, of Mozambique's Rural Water Authority, told Costello that "Once the pump breaks, and takes more than 3 months to repair, people in these communities no longer trust the PlayPumps" (Costello 2010c). The SKAT team in Mozambique also noted two pumps that had not worked since their installation several months before; one had not been repaired in 10 months, the other, 17 months (Obiols & Erpf 2008).

Erpf was of the opinion that the centralized maintenance and repair system, going through Roundabout Outdoor in Johannesburg, contributed to delays in maintenance (Obiols & Erpf 2008). UNICEF too saw it as a disadvantage of the system that breakdowns could only be reported by users in neighbouring countries, via SMS or phone call, directly to Roundabout Outdoor's offices in Johannesburg: "There is no local registration of O&M teams within the country of operation (outside South Africa) and no local accountability for the services they provide" (UNICEF 2007, p.12). "The administrative part of the maintenance system is too complicated and influences the reaction time between the receipt of the breakdown message and the actual pump repair intervention" (Obiols & Erpf 2008, p.37).

The fact that many user communities surveyed did not know how to report faults in the system also contributed to delays: in Mozambique "36% of the communities and school's management do not know what to do in case of a breakdown" (Obiols & Erpf 2008, p.38); while of *PlayPumps* inspected in Zambia "75% carried no contact details for the O&M teams and 63% of the respective schools and communities did not know who to contact in case of breakdown" (UNICEF 2007, p.12).

8. Users were not properly consulted before installation

In addition to users not being sufficiently informed about maintenance, Erpf reported that in Mozambique "the mission team also found no signs that communities had been consulted prior to installation or had a say in choosing the pump type of their choice" (Obiols & Erpf 2008, p.31). Costello found similarly – the women at an installation she visited in Mozambique said the first they knew of it was when the *PlayPump* was installed, and their community leader told them that this was where they should get water from now (Costello 2010b). Owen reports the same situation at a school in Malawi (Owen 2010a); and UNICEF found in their study that "there had been inadequate community consultation and sensitization", and that "users at 63% of PlayPump® sites visited in Zambia indicated that they were not adequately consulted" (2007, p.10). "There was not one community visited by the mission who claimed to have had a decision on the selection on the pump type to be installed" reports SKAT from Mozambique (Obiols & Erpf 2008, p.19).

9. *PlayPumps* often replace handpumps on existing boreholes

The lack of community consultation in the installation of *PlayPumps* was exacerbated by the fact that in the vast majority of cases, and contrary to the impression given by PlayPumps International and their partners, *PlayPumps* are not placed on new boreholes, so introducing water where there was none before, but on existing boreholes with broken or even working handpumps. This compounds the user dissatisfaction with the system, and their feeling of disempowerment, through not being consulted about the replacement of a technology to which they are accustomed. Of the 100 *PlayPumps* installed in Mozambique at the time of SKAT's study, 29 had been installed on new boreholes[7], and the remaining 71 had been

[7] These were very unusual – Roundabout Outdoor representative Colin Morris told me that **all** *PlayPumps* are installed on existing boreholes (Melman & Morris 2010); these 29 in Mozambique were installed during a project largely administered by World Food Program (WFP) and UNICEF (Obiols & Erpf 2008).

installed on existing boreholes – 28 replacing pumps that were no longer working, and 43 replacing pumps that were working, or had minor problems "easy to repair at community level" (Obiols & Erpf 2008, p.13). At two sites in Mozambique, Roundabout Outdoor's subcontractor replaced two-month old Afridev handpumps in perfect working order, on boreholes that had recently been rehabilitated by Concern International (Obiols & Erpf 2008).

Given the physical and psychological discomfit caused to adults by the roundabout, and the inferior performance of the pump relative to handpumps such as the Zimbabwe Bush Pump and the AfriDev, it is not surprising that many users told both the UNICEF and SKAT researchers that they preferred their previous handpumps to the *PlayPump*. Users in Mozambique complained about "the increase on time spent to collect water from 47 to 114 minutes after the installation of the PlayPump due to the heaviness of the pump and low yield and the fact that the water tank is never full" (Obiols and Erpf 2008, p.41). The same 63% of users who told UNICEF they had not been consulted, also told them that they "preferred the previous handpump that had been removed to make way for the PlayPump®" (UNICEF 2007, p.10). "Installation of PlayPumps® on boreholes which previously had a different type of pumping system (e.g. India Mark II or Afridev handpump) brings a lot of controversy to communities, since some users prefer the previous system" (ibid).

Users in Mozambique indicated that the distance they had to walk to fetch water had not changed much "because most of the pumps were installed on existing operational boreholes" (Obiols and Erpf 2008, p.41). "Many partners view the PlayPumps International implementation strategy as over-investing", noted UNICEF, "since it focuses primarily on replacing existing pumps instead of installing on new boreholes in schools that do not already have safe water supplies" (2007, p.13).

10. The system is much more expensive than alternatives

The *PlayPumps* project can also be seen as 'over-investing' because of the high cost of *PlayPumps* relative to handpumps. Not only does the *PlayPump* not work as well as other handpumps, but "you could provide at least four conventional wells with hand pumps and associated safe sanitation and hygiene education for the cost of one PlayPump" (Martin 2009, p.2). UNICEF notes with concern that "the cost of PlayPump® water system is high (approx. $14,000) and has increased dramatically in the last 2 years from the previous $6,500 without explanation to clients. Many partners had expected the cost to reduce to about $4,500 by now" (2007, p.13). They add that "key stakeholders in the water sector are not comfortable knowing that the $14,000 paid for each unit would have covered several conventional

handpump-equipped boreholes or wells, thereby providing safe drinking water to far more people than one PlayPump® can" (ibid). Paul van Beer of water NGO FairWater told Chambers of his frustration at the "millions of US dollars wasted" on the scheme (Chambers 2009). Though this cost is not borne by the user, funds for development projects, as Owen points out, are scarce, "and the challenges are immense in scale and importance"; as part of a basic cost-benefit analysis, we can't afford pointless "400% inefficiencies" in this sector (Owen 2010b).

To recount the major faults in the *PlayPump* system, the list is repeated here, as headings only:

1. The pump does not perform at the rate advertised
2. It fails to meet recognised standards for minimum water supply
3. Children's play is not the main source of input to the pump
4. The roundabout is painful and undignified for adults to use
5. The water tank is a hindrance to users
6. Advertising on the billboards is not a secure source of revenue
7. The maintenance system for the pumps is unsatisfactory
8. Users were not properly consulted before installation
9. *PlayPumps* often replace handpumps on existing boreholes
10. The system is much more expensive than alternatives

The suspicion that the *PlayPump* does not pump faster than the Zimbabwe Bush Pump was confirmed; so too the suspicion that it was rated to supply far more people than it could do while providing a recognised minimum amount of water. And evidence from the reports studied confirms that the effects of an inadequate water supply from the *PlayPump* are predicted by the impact of the prepaid meter noted in Chapter 6:

Food-growing suffered, with UNICEF noting that "there is often insufficient quantity of water to carry out other activities such as gardening and sanitation. Some schools actually stopped or drastically reduced their small-scale irrigation efforts as a result of this" (UNICEF 2007, p.9). Owen recorded the comments of teachers at a school in Malawi who told him they had to stop growing food when their handpump was replaced by a *PlayPump* (Owen 2010a).

The work of women and children increased, with people started to walk to other water sources: *Troubled Water* showed women in Mozambique whose *PlayPump* had been broken for several months, and who had to walk 40 minutes to the next village for water (Costello 2010c); Erpf noted the time spent collecting water increased with the *PlayPump* (2008). People who are sick or old suffered more, through not being able to turn the *PlayPump's* roundabout.

Where people with prepaid meters felt ashamed when their water or electricity was cut off, and social relationships deteriorated due to fighting over scarce resources, the *PlayPump* embarrasses women who have to use it, and it also causes social friction: Costello reported that the village which received a "daily influx" of 150 families from another village whose *PlayPump* had failed were upset by this draw on their resources, "causing tension" between the communities (2010b).

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