The failure of groundwater pumping technologies due to a dominant third-party actor: The case of PlayPumps International in Mozambique

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Introduction

In the early 2000s, the PlayPump was designed and implemented in thousands of locations within Mozambique and other African countries. The PlayPump was an innovative, exciting new approach to pumping water from the ground to use for drinking water. It was designed to harness the power of children playing to pump fresh water for their community (Stellar, 2010). These pumps replaced existing handpumps with the intention of improving the groundwater collection process.

Though initially promising, the PlayPump eventually resulted in failure. In 2009, PlayPumps International, the company that produced the pumps, announced that there were problems with the rollout and thus suspended production. Many scholars attribute the failure of the PlayPump to technological problems. The pumps proved to be insufficient ways of pumping enough water for the community. They also failed to address some of the more significant issues regarding water in these communities, such as water scarcity, or water quality.

However, solely considering its technological problems does not give a full understanding of why the PlayPump failed. The technological perspective is limited as it does not consider the social or cultural factors involved. It is important to take note of all of the actors involved, and understand their connection.

I argue that the PlayPump failed due to a lack of planning for all of the actors involved in the technology. PlayPumps International also failed to understand the importance of the interrelationship between all these actors. I will use a framework of Actor Network Theory (ANT) to organize my analysis of this case. Analyzing the PlayPump through this framework will give a complete account of why this technology resulted in failure. Specifically, I will prove

that the technology failed due to an inadequate interpretation of the network of actors and the lack of consequent actions taken to design for these actors.

Background

The idea behind the PlayPump design is simple: a children's carousel-type device is installed and connected to a water pump. When children play, and the carousel spins, groundwater is pumped up into a storage tank above ground, where the water is then available on demand (*How it works—Playpumps | Playpumps*, n.d.). This idea was initially developed after its creator, Ronnie Stuvier, saw how retrieving water was usually a difficult, tiring duty that women were responsible for (MacAskill, 2015). The goal of the PlayPump was to make this task easier. When Trevor Field, a British entrepreneur, saw a prototype of this technology, he immediately bought the patent from Stuvier with plans to implement this technology throughout Africa (Borland, 2015). Field established connections with government bodies and corporations in South Africa and sparked an international fund-raising campaign. In 2006, PlayPumps became internationally known and PlayPumps International was established by the Case Foundation to continue fund-raising (Borland, 2015).

Literature Review

Since its failure in 2009, the PlayPump has been analyzed by many scholars and writers. Many of these analyses focus on the different failures that the PlayPump exhibited. However, these pieces avoid commenting in terms of the lack of cohesion within the entire PlayPump network contributing to the technology's ultimate demise.

In *The Gameful World- The PlayPump,* Ralph Borland focuses his argument on the divide between western public perception of the PlayPump and the reality of PlayPumps. One of

the reasons it was possible to maintain a distorted vision of the PlayPump was because of the physical geographic separation between the users in the developing world and the audience in the developed world (Borland, 2015). This made it easy for the producers of the PlayPump to control the image of the technology in the field as it allowed for a "screen" separation between western audiences' view and developing users' reality (Borland, 2015). However, even when that geographic distance was mitigated, the distorted image of the PlayPump remained. This effect was experienced by several writers when they visited a PlayPump location and noted that the children were "performing to the expectations of outside onlookers," (Borland, 2015). Borland goes in depth about how this distortion between western audiences and developing-world users was developed and how it contributed to the failure of the technology. However, he does not look into the network of actors present or delve deep into how all of the actors are connected.

In *Social Enterprises as Supply-Chain Enablers for the Poor,* ManMohan S. Sodhi and Christopher S. Tang take a very different approach to evaluating why the PlayPump failed. The argument reflected in this piece articulates that the PlayPump failed because it did not enable consumers or microentrepreneurs (Sodhi & Tang, 2011). This article highlights the importance of giving opportunities to poor people to become producers: creating jobs, increasing income levels, and improving their quality of life (Sodhi & Tang, 2011). Sodhi and Tang explain the three specific factors that prevented users of this technology from becoming microentrepreneurs: the immense equipment and maintenance cost, water scarcity, and forced child's play (Sodhi & Tang, 2011). This piece uses the PlayPump as an example of a failed attempt to be a social enterprise that helps the poor gain access to water. Again, they do not connect the PlayPump's

failure with the network of actors present and the resulting gap between the actors' needs and the PlayPump's design.

The existing research done on this case synthesizes the stark differences and subsequent miscommunication between the developing and developed world. While these perspectives give insight into the PlayPump's failure, neither give a complete account of why this technology failed. There is much to be learned about the PlayPump as a failed means of using the poor as producers and the distorted image of the PlayPump between the users and the audience. However, the current works fail to completely diagnose the multiple problems that the PlayPump faced that ultimately led to its failure. This paper will provide a complete analysis of all of the human and non-human actors in this network, and it will also develop a judgement of why the incorrect consideration of each actor contributed to the ultimate demise of the PlayPump.

Conceptual Framework

ANT serves as an excellent framework for identifying chains of responsibility in systems with multiple interacting subparts. This paper will follow the framework as laid out by Michel Callon and Bruno Latour, the two primary developers of the theory. ANT is a framework that examines power dynamics between human and non-human actors in heterogenous networks (Callon, 1987). These power dynamics are defined solely by the relationships between the relevant actors. Power is established through the strength of the relationships, rather than the independent strength of each actor (Latour, 1984).

ANT also allows for tracing of the progression of the network through Callon's concept of translation (Callon, 1984). Translation describes the process in which actor-networks are formed around a primary actor, the network builder. Callon summarizes translation in four

moments: problemization, interessement, enrolment, and mobilization (Callon, 1984). Problemization is when a network builder appears and defines the nature of the problem. In interessement, the network builder recruits other actors in the network and aligns their interests with the problem. During enrolment, the network builder assigns roles to the other actors and they must accept and follow through with these roles. In mobilization, the network builder assumes the role as spokesperson for the actor-network, and the actor-network starts to operate cohesively. If one actor cannot perform the role assigned to it, the entire actor-network can break down (Callon, 1984).

ANT is an effective framework to characterize the PlayPump network because it allows for the individual evaluation of each intermingled heterogeneous component. Analyzing the PlayPump with this framework will provide an in-depth examination of each actor's perspective and needs in the overarching network. I will use this framework to argue that the network builder failed to adequately consider the perspectives of each actor and this therefore led to several actors being unable to perform their assigned roles, resulting in the technology's eventual failure.

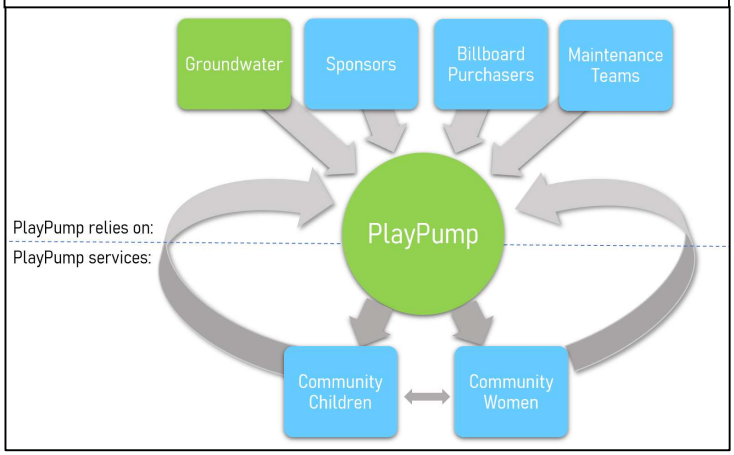
Analysis

Network Reconstruction

In order to analyze the PlayPump case, it is essential to reconstruct the network surrounding this technology. This process first involves defining the heterogenous actors within it and examining how they are interconnected. I have laid out the human and non-human actors present in this network. The network builder in this case is Trevor Field, the man responsible for creating this network and recruiting the other actors. Human actors include (i) the community

children, (ii) the community women, (iii) maintenance teams, (iv) the sponsors, and (v) the billboard purchasers. Non-human actors include both (vi) the groundwater and (vii) the PlayPump itself. These actors and their relationships are represented in Figure 1.

Figure 1- PlayPump Network. Human and non-human actors



For this analysis, I will draw primarily upon a mission report conducted by the Rural Water Supply Network (RWSN) on PlayPumps installed in Mozambique, an objective report of the situation. I will also primarily center my argument around PlayPumps in Mozambique, as this was the country where the majority of the PlayPumps were installed.

To understand the perspectives, roles, and needs of each actor, it is important to fully analyze each actor in an isolated setting.

i) *Children.* The PlayPump was designed to be used by children from communities across Mozambique. PlayPumps were installed in these children's schools and communities without their consultation and they consequently were expected to spin the wheel to provide water for the community. The PlayPump had a radical effect on children in these communities as it made children responsible for the task of water pumping, a task that they previously were not responsible for (*How it works—Playpumps | Playpumps*, n.d.).

ii) *Community Women.* The women in these communities are historically responsible for retrieving water for the family. The methods necessary to retrieve the water are very

important for this group of people as it affects their everyday life. Changing the system from a simple handpump to one that requires spinning of a playground fixture creates a drastic change in their lifestyle. This was done without asking the communities if they would prefer the Playpump over a handpump (Obiols and Erpf, 2008). Women are also interconnected to the children because PlayPumps were often built to be shared between schools and communities (Obiols and Erpf, 2008).

iii) *Maintenance Teams.* Two teams were responsible for maintaining and repairing all PlayPumps across Mozambique (Obiols and Erpf, 2008). The maintenance teams are crucial in this network because they are the only people capable of fixing the PlayPumps. This was an important job as the PlayPumps often failed and were not easy to fix (Obiols and Erpf, 2008).

iv) *Sponsors*. With a very high initial cost, PlayPumps needed international backing and sponsorship in order to promote a widespread use. Sponsors raised US $60 million to fund the construction of 4,000 PlayPumps (Borland, 2015). Western sponsors were eager to write donations for a technology that was sold as a way to convert child's play into a water supply, reducing the tedious work of women in the villages of Africa (Borland, 2015). Sponsors were given a misleading understanding of the water challenge in Africa. Without sponsorship, the PlayPump would not have become so widespread in Mozambique.

v) *Billboard Purchasers.* When the PlayPump was first developed, the cost of it was too expensive to become reality. However, Field had a great idea to fund them: install four billboards around the water tank and persuade people within the community to purchase

advertisement space. It was intended that the revenue of two commercial advertisements would provide enough to cover all maintenance costs (Obiols and Erpf, 2008).

vi) *Groundwater.* The PlayPump relies on groundwater to achieve its goal. The PlayPump provides water to communities by utilizing the water below the surface of the Earth and extracting it for people to drink (*How it works—Playpumps | Playpumps*, n.d.).

vii) *PlayPumps.* This actor is interconnected to all of the other actors in different ways. The PlayPump is advertised to service the communities that it is implemented in, including the women and the children. When initially analyzing the network that surrounds the PlayPump, it is easy to determine that this technology relies on the other actors in this network: the groundwater, the maintenance teams, and the sponsors (including first-world donors and local billboard purchasers). However, when delving deeper into this analysis and examining all of the actors, it becomes apparent that the PlayPump also relies on the women and children for its success. Though the PlayPump appears to solely act as an aid to these actors, it also needs them to facilitate correct functionality of the technology.

Failure to Consider all Actors

Within this network of several interconnecting components, several key actors were not considered in the planning and development process for the PlayPump. The PlayPump's development did not successfully go through the phase of interessement, when the actors are recruited and their interests are aligned with the problem in the synthesized network. The network builder, Trevor Field, failed to ensure that all of the actors' needs and interests were aligned with the problem. This misalignment led to the failure of the technology. The main actors that were not considered during the translation process of this technology were the children, the women, the groundwater, the billboard purchasers, and technical aspects.

Children

In the report completed by Obiols and Erpf, it is reported that "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." (Mission Report, 2008, pg 30). This is controversial as the product was specifically marketed as "a sustainable pumping system… that is powered by the play of children" (*Playpumps | Home*, n.d.) The PlayPump demanded that the children work if they want their community to have water. In this case, the network builder only achieved part of the interessement phase. He recruited the children as actors, but did not align their interests with the problem and did not consider their wants and needs. No research was done to understand if the merry-go-round was a common piece of equipment on a school playground, whether children would enjoy using it, or showing it, and other options, to the children before moving forward.

When the PlayPumps were implemented, it became apparent that the children were not using them as much as the network builder had anticipated and planned for.

> "In most schools visited, children were not always moving the play wheel – they often enjoyed the PlayPump as a gathering place, just sitting on it and chatting. However, as soon as the evaluation team (foreigners) walked towards the PlayPump, the children rushed to the pump (like they have been told), showing their ability to rotate the play wheel at an enormous speed. The children pushing the wheel with such a high speed could only keep up this pace for a few minutes before being exhausted," (Obiols and Erpf, 2008, p. 24).

Not only did the children commonly find themselves not playing on the PlayPump, but they felt an obligation to play on it in front of the foreigners. The uncomfortable treatment of the

children in this scenario demonstrates how assumptions were made about this actor, without valuing this actor as an important player in the success of the technology. This proves that the network builder failed to align this actor's interests with that of the issue. This raises an ethical question as the PlayPump insinuated that physical labor was just "child's play" (*BBC NEWS | Africa | Why pumping water is child's play*, n.d.). Making the decision to market it this way also ran a risk of causing the technology to not work as intended. In *The Gameful World- The PlayPump*, Borland says, "Matching children's play—by most people's definition a voluntary, sporadic activity—to the achievement of an everyday, essential task in resource-poor settings was a high-stakes gamble" (Borland, 2015, p. 331). Relying on people to voluntarily provide a service cannot ensure that the service will actually be done, especially when the people in question are not considered in the design process.

Community Women

During the translation phase of this technology, the community women were also not accurately analyzed. Many PlayPumps were built to be shared between communities and schools. This shared pump concept sounds like a great way to include both the school children and the community women, "but it has proven to be the most problematic approach and leads to conflicts between the different users," (Obiols and Erpf, 2008, pg. 19). Women often had to push the PlayPump around to retrieve water because there wasn't enough pumped by the children's playing (MacAskill, 2015).

> "Adult water users refuse to sit on the play wheel and to move it with their feet. A strange operation technique that has so far not been accepted by African women. All users prefer to stand outside of the play wheel and rotate it by pulling the outer ring by hand. Pregnant

> women refrain from drawing water after their belly is getting too big for operating the play wheel and elderly people have no chance to move the play wheel for getting water. Used for many years to operate the handpump by a handle, almost all pump operators (only women) are not happy with the pulling movement to turn the play wheel," (Obiols and Erpf, 2008, p. 24-25).

This demonstrates the importance of the women's interconnected relationship to the community children, as they often had to complete the task that was assigned to the children by the network builder. By the power of translation, the network builder failed to align the women's interests to the problem by failing to align the children's interests. This evidence shows one example of how important interconnected relationships between actors are, and how each failure in an actor-network has a ripple effect on the other actors. This failure continued to ripple as the women were not comfortable using the PlayPump to pick up the children's slack. Since the PlayPump was marketed as child's play, women found it demeaning and uncomfortable to do this task (Borland, 2015). Also, as shown in the report, this method of pumping water ensured that elderly and pregnant women were unable to use the device in times of need. This made the task of pumping water significantly more difficult for all parties involved. By not aligning the women's interests with the nature of the technology, the PlayPump was predestined to fail.

Groundwater

Mozambique struggles with a lack of water and poor water quality (Borja-Vega et al., 2018). This pump did not aim to solve either of those problems. In some cases, pumps were installed at unsuitable sites, and other times, too many pumps were installed in nearby

communities which caused the supply of groundwater to be unable to meet the demand (Sodhi and Tang, 2011). Additionally, the quality of the water was a problem as there are corrosive waters in much of Mozambique. The frequency of these two problems are reflected in Figure 2. Even though the main actor that the PlayPump relies on is the groundwater, the network builder ignored the existing groundwater problems in this area which inherently set it up to fail. The real water problem in Mozambique lies in the quantity and quality of available groundwater, not in the methods used to pump it.

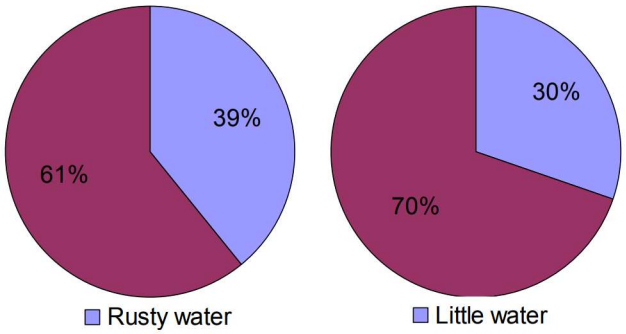


Figure 2- Groundwater Problems. 26 PlayPumps were visited in Mozambique to evaluate them for various problems. The results are represented in this figure (Obiols and Erpf, 2008).

I argue that the network builder failed to accurately align this actor's needs with the problem at hand. One could argue that the network builder did not fail in any aspect of the translation phase. Given that the groundwater is a non-human, natural entity, it is impossible for the actor's "interests" to be aligned with the problem and for the actor to accept the role. However, I argue that the network builder is still responsible in this sense. For this actor, the enrolment phase should have included a groundwater evaluation and specific plans for how the rollout of the PlayPumps could harness enough good quality water in these conditions. "Problems with corrosion of metal parts (GI rising mains and MS pumprods), dry wells and collapsed boreholes started soon after installation of the PlayPumps. This showed clearly that fundamental information of the assessment was not correct or missing (water quality, characteristic of boreholes etc.)" (Obiols and Erpf, 2008, p. 30). Since these steps were not

taken, or not documented properly, the network builder is still responsible for this actor not properly accepting its role.

Billboard Purchasers

The billboard purchasers were also not aligned accurately in the interessement phase as "The mission noted that many of the visited PlayPumps had blank billboards and some also no signboards," (Obiols and Erpf, 2008, p. 23). The network builder did not fully comprehend who the billboard purchasers would be and if ad-space on the PlayPump was something they desired. When PlayPumps had no billboard purchasers, no revenue was being generated, therefore there was no money to repair them when they broke. In terms of this actor, the network builder did not accomplish any of the interessement phase as he did not even correctly recruit actors for this role.

Technical aspects of the PlayPump

Many technical factors were not fully considered in the development of the PlayPump, which led to not enough water being pumped, pumps frequently breaking down, and the maintenance teams being unable to promptly fix these problems. The high cost of the PlayPumps was a severe problem as it made it difficult for local communities to be able to install and maintain the pumps. Specialized labor skills and specialized spare parts, two things that these communities did not have access to, were required to repair them. This forced residents to have to rely on PlayPumps International and support from the maintenance team to have constant access to a fresh water supply (Sodhi & Tang, 2011).

Table 1- Pump Breakdowns. Comments on pump failure in 11 communities (Obiols and Erpf, 2008).

Nº	Pump Number	School	Beneficiaries	Instalation Date	Breakdowns since installation	Breakdowns in the last 3 months	Type of Problems	Downtime (Days)
1	MOZ0006	EPC Mabanja	School	2005	1	1	Pump heavy	120
2	MOZ0001	EP1 Intaca	School	2005	3	2	Little water flow, tap	21
3	MOZ0021	EP1 Chonguene	School	2006	1	1	Little water flow	120
4	MOZ0015	EP1 Chaguala	School/Community	2006	1	0		60
5	MOZ0017	EP1 Tetene	School/Community	2006	3	1	Tank do not keep water	300
6	MOZ0041	EP1 Magul	School/Community	2006	3	2	No water flow	30
7	MOZ0008	EPC Tenga	School	2006	1	1	Tap	15
8	MOZ0054	EPC Siaia	School	2006	1	0	No water since installation	520
9	MOZ0062	EP1 4 de Outubro	School/Community	2007	1	1	Little water flow	60
10	MOZ0014	EP1 Coca Missava	School/Community	2006	1	0	Little water flow	20
11	MOZ0055	EP2 Chalala	School/Community	2007	2	1		90

Table 1 shows qualitative and quantitative data for 11 communities that experienced a breakdown of their PlayPump. Based on this data, the average downtime is 60 days. Without the knowledge or tools to fix the pumps themselves, communities were left helplessly without access to water for an average of 60 days at a time. As shown in the table, many of these communities faced other problems such as low water flow in addition to their pumps breaking down. These technical aspects of the PlayPump affect many of the human actors in this network. With frequent pump failure, the maintenance team was overwhelmed with work and communities were left without access to water. This left all parties upset with the functionality of PlayPumps and with a desire to return to the manual handpumps (Obiols and Erpf, 2008). The network builder introduced a product to these communities that did not work as intended. His failure to recognize and design for the technical needs contributed to the ultimate failure of the actor-network.

Conclusions

The PlayPump is an example of a technology that had innovative features, great intentions and a hopeful positive impact on the communities it was implemented in. In this paper, I have used the sociotechnical framework of ANT to methodically collect and deconstruct

the PlayPump actor-network. This allowed me to identify the root cause of why this technology resulted in failure: the network builder's lack of attention payed to each individual actor in this network. By analyzing each actor, it becomes apparent that the network builder focused his attention on setting the narrative of the PlayPump, a tactic to please and solicit money from western viewers, rather than directing his attention toward the people that this technology was aimed to help. With this awareness, the general reader will be more cognizant of misleading technologies and their potential for being detrimental to the communities that they are established in. Attempting to do good is not good enough when your attempt actually hurts the people you are aiming to help. If we don't recognize this fact, we will not be able to learn from our mistakes and produce better performing technologies in the future and we will continue to hurt communities in need.

Word Count: *3925 words*

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