

The Likuni Water Development Project Report

28 August – 25 September 2010



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Executive Summary

From 28 August to 25 September 2010, the Scottish charity Water Works launched a water development project, funded by the University of Edinburgh Development Trust, in a community in Likuni. This community comprises 8 rural villages outside the Malawi capital Lilongwe. The nature of the project, its implementation strategy and its objectives were based on the 2010 Master of Engineering Thesis at the University of Edinburgh: "Sustainable Handpump Project for Malawi's Rural Poor" by Mikael Ullerø.

As a representative of Malawi's rural poor, the community in Likuni had never received any support by governmental agencies for the provision of reliable and safe water sources. As a result, villagers had seen no other solution than to take these water issues in their own hands by digging shallow wells. Still, the fact that these shallow wells were unprotected represented a great risk of contamination of the water, especially in the flood season. As a result, the aim of Water Works' intervention in Malawi was to help the Likuni Community protect its wells, by teaching the population about a pump technology which could be built, operated and maintained entirely through local initiatives, without any need for outside assistance.

The implementation strategy, which was reassessed halfway during the Project Period, was to teach the project beneficiaries how to perform their own projects by implementing two pilots with them. The objective of the first pilot was to demonstrate how the project should be performed, while the objective of the second pilot was to verify that the beneficiaries were capable of performing the project themselves, under their own management.

The Water Works intervention was a success. Upon departure of the Water Works team, project representatives of the Likuni community had demonstrated through the second pilot that they were capable of duplicating the outcomes of the first pilot, and that they were also capable of constructing a pump and well protection which outperformed the initial design, in terms of performance, robustness, use of local materials and aesthetics. As a result of this success, an agreement was signed between the Likuni Water Committee and Water Works, committing the Likuni community to implement another 6 well projects in their own time, after the departure of Water Works.

On 15 November 2010, Water Works received the September Monitoring Report of the Likuni Water Development Projects. The report indicated that a total of 4 upgraded water points now were operational in Likuni, implying

that 2 projects had been completed by the Likuni community in September. The Monitoring Report of November is expected in mid-December 2010.

Abbreviations

CMM: Community Management Model

O&M: Operation and Maintenance

RWSN: Rural Water Supply Network

SS: The Sustainability Snapshot

SSM: Self Supply Model

VLOM: Village Level Operation and Maintenance

WEDC: Water, Engineering and Development Centre

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1. Introduction

On 14 May 2010 the University of Edinburgh Development Trust awarded a Small Project Grant to allow an implementation in situ of the research presented in the University of Edinburgh MEng Thesis entitled “Sustainable Handpump Project for Malawi’s Rural Poor”. The thesis research was about developing a hand pump project model which was tailored to meet sustainability requirements for 8 villages in Likuni, a representative community of Malawi’s rural poor, located outside the Malawi capital, Lilongwe.

The project deriving from this research was performed by the Scottish charity Water Works in the 8 villages in Likuni and started on 28 August 2010. The period in which Water Works was directly involved in the project, called the “Project Period”, ended on 25 September 2010. At the time of writing, though, the construction of handpumps in Likuni is still in process.

This report aims to provide a detailed summary of the Project Period, including its achievements and the difficulties faced, and the most imperative lessons learned. Firstly however, this report will present a detailed summary of the MEng thesis research with its conclusions, as these provide the rationale behind the Project Period Implementation Strategy and its objectives. More importantly, the thesis also provides an insight into what is meant with achieving sustainable handpump projects for Malawi’s rural poor.

2. Summary of Thesis

2.1 Motivation and Thesis Aim

The motivation for the Master of Engineering thesis titled “Sustainable Handpump Projects for Malawi’s Rural Poor” came as a result of a survey performed by the charity Water Works in rural Malawi in the summer of 2009. The aim of the survey was to get a first hand overview of the current rural water coverage in the country. (By rural water coverage it is meant the accessibility to safe drinking water within less than 250 meters (Sudgen, 2003)). The conclusion of this survey was that rural water coverage in the country could be as low as 50%, a dramatic difference from the figures presented by the World Health Organisation in 2008 of 77% (WHO/UNICEF, 2008).

According to the findings of the survey, this considerably low rural water coverage was due to two reasons. The first reason was that a large majority of the “engineered” rural water points visited, such as shallow wells with handpumps or boreholes, were broken. The second reason was that for some rural communities, engineered or safe water points were simply missing. These communities did not have the capacity to provide such facilities themselves and were waiting for aid from external agencies, which they had to that date never received.

The thesis aim was articulated based on these two observations. It proposed an alternative implementation model to conventionally engineered water point projects, tailored for Malawi’s rural poor, potentially implemented without outside assistance, and meeting imperative requirements for handpump sustainability.

2.2 The Representative of Malawi’s Rural Poor: The Likuni Area

The Likuni Area, a peri-urban settlement outside the capital Lilongwe, was selected as a representative community of Malawi’s rural poor. The Likuni Area was first visited during Water Works’ survey in the summer of 2009, during which a detailed water and sanitation census was performed by the Likuni Water Committee at the request of Water Works.

The Likuni Area comprises 8 villages having a total of 36 open shallow wells as only source of drinking water. Although many of these open shallow wells

have been dug by local well owners to impressive standards (some wells are as deep as 15 meters), the fact that the wells are unprotected represent a great risk for well water contamination. This is especially the case during the rainy season where these unprotected wells are vulnerable to floods. During the rainy season in 2008, the Likuni Area suffered greatly from an outbreak of cholera.

The Likuni Area has never received aid to protect its shallow wells because government policy for this area is to connect Likuni to the water grid of Lilongwe. It appears, however, that government funding to perform this connection has never been available, and that the villagers of Likuni would in any case be unable to afford the water tariffs associated with such a connection.

2.3 Three Fundamental Requirements for Handpump Sustainability: "The Sustainability Snapshot"; Demand; and Creating Ownership

Defining handpump sustainability without a set context is ambiguous and it has been recognised in numerous publications from WEDC, RWSN and WaterAid to rather identify tools or requirements for the measurement of handpump sustainability. Over the past 5 years, WaterAid has developed a tool called the *Sustainability Snapshot* (SS) (Sudgen, 2003). The SS is conceptually simple, consisting of measuring the sustainability of a water development project through a community's physical capability of performing preventive maintenance. The SS comprises three criteria which can be summarised as a community having:

- funds to carry out repairs;
- skills to carry out repairs;
- access to tools, materials and equipment to carry out repairs.

Although the SS is an effective tool to measure a community's capacity to perform preventive maintenance on its water point, it has been criticised in publications, such as Harvey and Reed (2003), to be a prescriptive derivation of a project observation which does not measure another crucial criterion: the community's *demand* for a project. One of the main reasons why improved water points fall into disrepair shortly after their installation is that when the pump breaks down, the users are more likely to go back to their traditional water sources, such as rivers lakes or open shallow wells, rather than going through the trouble of repairing it (Carter, 2009). In other words, the users

demand for a water point is not strong enough. In many ways, the goal of educational practices in project implementation strategies is to improve demand. The aim of hygiene education, for instance, is to increase the demand for a water point project through the promotion of the benefits of having access to a safe source of potable water.

Unarguably, a clear demand for a project and the criteria outlined in the SS are fundamental prerequisites to achieve a sustainable water point project. One additional, but decisive requirement, is created during project implementation. This last requirement is the community's *ownership* of the project. Not fully including a community in project stages such as: decision making in choice of technology or choice of site; resource procurement in terms of materials and funding; labour; and/or project management has proven to compromise a community's ownership to a project, which subsequently results in a reduced willingness and/or capacity to sustain the project (Parry-Jones et al., 2001).

2.4 Conventionally Engineered Water Pump Projects

The conventional approach to water pump projects in most Sub-Saharan countries today, such as in Malawi, is through the Community Management Model (CMM) with the promotion of prefabricated reciprocating pumps.

2.4.1 Attributes of Conventional Water Pump Projects

The main CMM attributes are as follows:

- The initiative for the project is predominantly taken by the supporting agency, such as governmental agencies or charities, and usually not by the beneficiary community (Carter et al., 2005);
- The project output, such as a shallow well protection fitted with a handpump, is to be owned by a community and not by private owners. Most supporting agencies under the CMM are reluctant to assist individual households, as they fear that the assistance to individuals will undermine their commitment to help communities (Carter et al., 2005);
- The CMM aims to promote ownership through community participation in the construction phase of the facility, by contributing in the initial planning, cost recovery and labour (Montangero, 2009);
- During the commissioning of a project, a team of 10 to 14 people from the community are trained by the supporting agency to

- perform the operation and maintenance (O&M) of the pump. This team is called the “Water Committee” (Montangero, 2009);
- It is widely recognised that a community requires a continued flow of benefits and support from the supporting agency after the commissioning of a water facility, to secure that the facility is sustained (Harvey and Narkevic, 2009).

The main characteristics of the Reciprocating Pumps are as follows:

- The last generation of reciprocating pumps, also called VLOM pumps (Village Level Operation and Maintenance) were developed in the mid 1980s with the requirement that the pumps could be maintained locally, thus adhering to the CMM, given that spare parts were available (Wood, 1994);
- The production of the VLOM pumps and its spear components are predominately done in India and Pakistan where manufactures benefit from much more competitive markets than in Sub Saharan Africa (Hankin, 2001).

2.4.2 An Example: The Maluwa Project

As an addition to the survey, the charity Water Works implemented a project for up to 500 inhabitants of a rural community called Maluwa, outside the industrial capital of Malawi, Blantyre. This project involved the construction of a community well in cooperation with officers from the Ministry of Health in Malawi, and adhered to the community management model with the installation of a reciprocating pump called the Malda.

Due to Water Works’ time restriction, it only took one month from informing the Maluwa community about the project until the well was finished. Attempts were made prior to the construction to involve the community in the funding of the project and in procuring material. However, due to time restriction the community members were only capable to contribute in kind by gathering sand and quarry stones. Most of the involvement of the community was through labour, performed together and under instructions from representatives of the Ministry of Health and Water Works. After the installation of the well, the ministry officers established a Water Committee comprising 8 women and men from Maluwa with the responsibility of the O&M of the water point.

One year later, in September 2010, when Water Works representatives visited Maluwa again, the water point had fallen to disrepair. The plunger, which is

the component creating the suction in the rising main of the pump, was worn down due to excessive use. Attempts had been made by the Water Committee to repair the pump, but as was explained, the committee did not have the adequate training nor the tools to perform such a repair, and although it had managed to collect funds for spare parts, they did not know where they could purchase a new Malda pump plunger.

The failure of the Maluwa project after only one year is not a unique case, but a common observation for almost half of all conventional water pump projects in Malawi (Pump Aid, 2010). Common to these projects is that they do not meet the fundamental requirements for handpump sustainability. When analysing these requirements for the case of the Maluwa project, it becomes clear that:

- Due to time restrictions, the fostering of ownership in the community was compromised. The community was not given sufficient time to procure materials and contribute to funding;
- Ownership was also compromised by insufficient involvement in project management and decision making, for instance concerning the choice of pump technology;
- Although a certain demand for an improved water source had been registered in Maluwa, the initiative for the project was taken by officers from the Ministry of Health, not by the community of Maluwa. Furthermore, the limited involvement of the community in the project compromised the impact that hygiene education could have on increasing demand;
- None of the sustainability snapshot criteria were fully met: the training of the committee was inadequate and the pump technology was inappropriate.

2.5 The Thesis Research

An alternative, more sustainable model for water pump projects compared to conventional CMM with VLOM pumps, consists in adapting a relatively new management concept in water development, *the Self Supply Model*, and an ancient Chinese pump technology, *the Rope Pump*.

2.5.1 The Self Supply Model and Likuni

While the CMM is affiliated to projects owned by a community, the Self Supply Model (SSM) is affiliated to projects which are owned by private

initiators. All the 36 hand-dug wells in Likuni have been built by private owners through private initiatives, and have thereafter been managed by their owners. The Likuni water census showed that although privately owned, 97% of all private owners were happily sharing their wells with neighbours. Thus, implementing a water development project on existing wells in Likuni under a SSM would not change the existing management system, which was already based on a self-supply philosophy, and would target the same amount of individuals as under a CMM.

One main characteristic of the SSM is that initiative, decision-making and project management are performed by the private initiator, while the supporting agency has an advisory role (Carter et al., 2005). Well owners, who have already demonstrated their demand for a project by digging a well on their own initiative and investments, are given the option to upgrade their facility through a pump technology transfer, bearing in mind that he or she will have to take the responsibility of managing the project.

The advantage of the SSM on the CMM is that a project will not run unless the demand is significant. Equally important, as argued by Carter et al. (2005), while the ownership created through the CMM lays only partially with the community, the ownership deriving from the SSM is clear, as initiative, implementation and cost-recovery (cash/labour) lay uniquely with the owner.

2.5.2 The Rope Pump and Likuni

Knowing that conventional reciprocating pumps would very likely not meet the Sustainability Snapshot criteria for water pump projects in Likuni, a pump design was developed with the aim to meet these criteria, based on materials and skills available in Malawi. The result was the “Abakus”, an adaptation of the Rope Pump technology. Two important assumptions in the design of the Abakus were that the availability of timber and the skill of working with wood would be high in a rural community such as Likuni; and that even the poorest rural communities in Malawi would have access locally to bicycles and bicycle parts.

The Abakus pump, which was built and tested on the Mckeand farm in Biggar in February 2010, had the following characteristics:

- Most of the materials and tools needed for the Abakus were believed to be available within a local rural community such as Likuni, at an affordable cost for a private initiator. These materials

- comprised timber and bicycle materials (wheel and pedals). The availability of PVC pipes and rope, however, was not guaranteed;
- The Abakus pump was designed so that all components could be built and assembled on site and with local skills;
 - The discharge test of the pump yielded 40 litres per minute;
 - The conclusion drawn from testing the pump's ease of operation was that it would be suitable for women if operated by two people;
 - No practical durability test was performed on the pump.



Figure 2.1: Test of the Abakus pump at the Mckeand Farm

2.5.3 Theoretical Implementation Strategy

Based on the Likuni water census submitted to Water Works in the summer of 2009, a theoretical implementation strategy of a project following the SSM and with an Abakus pump technology transfer was developed, attempting to define the roles of all stakeholders involved. This theoretical strategy was divided into three stages: the pre-construction phase; the construction phase; and the post-construction phase.

The key aspect in the pre-construction phase was time. The assumption was that in order to establish a full demand for the project and a good foundation

for ownership, the external agency, the well owners and their respective users needed to spend enough time on: sighting the wells; clarifying project benefits; allowing well owners to make informed decisions on the pump technology; and allowing well owners to demonstrate their building capacity by procuring materials, accessing funding and recruiting well users for labour.

On the condition that the well owner had fully understood the mechanism of the Abakus pump during the pre-construction phase, the implementation strategy articulated for the construction phase was that the well owner would coordinate the construction and installation of the pump, as well as the construction of the well protection, using local labour and expertise. The role of the external agency would be to advise the well owner; quality control; and funding the procurement of expensive, but indispensable materials for the well protection, such as fired bricks and Portland cement. The focus of the external agency concerning hygiene and health education would be on the well owner, as it was assumed that his or her habits would influence the habits of the other users of the well.

Assuming that the two preceding phases went as predicted, the post-construction stage would only require establishing a simple and effective system for monitoring the O&M of the water points. The well owners and the users, on the other hand, should have acquired ownership for the project and have the capacity to continue managing the projects without further external assistance.

2.6 Thesis Conclusions and Spinoff Expectations

An important reminder in the thesis conclusion was that as long as the research had not been tested in situ, it was impossible to state whether or not the overall aim of proposing a water pump project for rural Malawi which was more sustainable than conventional projects, was met. However, the thesis concluded that the potential for achieving sustainable handpump projects was realistically high, considering that the three fundamental requirements for sustainable handpump projects were the cornerstone of the experiment.

The anticipated “spin-off” effects of the Likuni Handpump projects were summarised as follows in the conclusion of the thesis:

- If the projects were successful, other private owners in Likuni might wish to construct the Likuni Rope Pump entirely on their own

initiative. Subsequently, this could also spread to other surrounding villages;

- A successful project might lead to a “ladder of improvements” where the technology was perfected locally until optimally adapted to the users’ needs and level of acceptance;
- The project might result in a boost in the local economy through for example the stimulation of carpentry and brick manufactures;
- In time, with a number of private initiators managing water points in a more professional way and gaining expertise on the pump technology, one might see a transition from the Self Supply Management to a Handpump Leasing Management Model, where private manufacturers own and install handpumps in communities under clear maintenance contracts.

3. The Likuni Water Pump Project 2010

On 14 May 2010, the University of Edinburgh Development Trust donated £5000 to perform the Likuni Water Pump Project as a practical application of the thesis research. The project was performed by 4 volunteers of the charity Water Works. The period during which the volunteers were present in Likuni, called the “Project Period”, was from 28 August to 25 September 2010.

3.1 Objectives for the Project Period

The overall aim of the operation was to see if the Likuni Pump Project is more sustainable for Malawi’s rural poor than conventional water pump projects. At the stage of writing, it is however too early to conclude whether this aim has been met or not.

Before starting the project, milestones for the Project Period with clear objectives were defined in order to meet the specified overall aim. These milestones were as follows:

1. Organise a meeting between the Water Works representatives and the Water Committee of Likuni, women representatives from all 8 villages in Likuni and the Likuni Village Head Men. In this meeting the project objectives, the choice of pump technology and well sitting are discussed. The objectives are:
 - a. To help the Likuni representatives understand the mechanisms of the Abakus pump, in addition to the pump’s advantages and disadvantages;
 - b. To reach an uniform agreement on which private wells to perform the projects on;
 - c. To have a unanimous agreement on the implementation of a pilot project with the Abakus pump on one of the wells;
 - d. To help the Likuni representatives understand their roles and the desired outcomes of the pilot project.
2. Perform a pilot project with the Abakus pump. The objectives are:
 - a. To investigate whether or not the skills, tools and materials needed to construct the Abakus pump are available locally;
 - b. To teach the well owner and users of his/her well how to build the rope pump;
 - c. To verify that the Abakus pump meets the performance criteria for operation as specified in the thesis;

- d. To verify that the well owners and the users are capable of implementing similar projects without assistance;
 - e. To perform hygiene and health education with the well owner and his/her users.
3. Organise a second meeting between the Water Works representatives and the representatives of the Likuni community. In this meeting the Abakus pump built in the pilot project is tested by the community representatives and the remaining project strategy is discussed accordingly. The objectives are:
 - a. To help the community representatives make an informed decision on whether or not they want to do the remaining projects using the Abakus.
4. Perform the remaining four projects with the Abakus pump. The objectives are:
 - a. To install the four remaining well upgrades in the same manner and standard, if not better, as the pilot project.
5. Establish a reporting system which will allow the O&M of the five projects monitored by Water Works for one year after the Project Period. The objectives are:
 - a. To teach well owners how to monitor the installation, performance and maintenance of their wells;
 - b. To develop a strategy with a contact person in Lilongwe to report this monitoring to Water Works.

3.3 Project Period Chronology and Achievements

Soon after the Small Project Grant was awarded, Water Works' contact person in Likuni, former CIDA (Canadian International Development Agency) representative Mr. James Mambulu, was contacted and asked to inform the Water Committee of Likuni on Water Works' arrival date and to ask the community to start preparing for the project. The Water Committee was asked to organise the procurement of materials needed for the project. The project started on 28 August with a meeting concerning milestone 1.

3.3.1 The Initial Meeting with the Likuni Community

The first meeting, held in Mtomondo Village, was attended by the Water Works representatives and Mr. Mambulu, the Likuni Water Committee including the Water Committee Chair, Mr. Black, the Village Head Men from each of the 8 villages (Mtomondo, Nachipi, Chimphangu, Mnjolo, Mchawa, Nkhongoni, Kumlambala and Chitsinde) and, by special request from Water Works, women representatives from each of the villages. The main focus of the meeting was to inform Likuni on Water Works' intended project strategy.

Communication proved to be a challenge during the meeting. Only Mr. Black and a few other Likuni representatives, such Mr. Banda, the Water Committee Secretary, could speak proficient English. The interpreter from English to Chichewa was Mr. Mambulu.



Figure 3.1: The Initial Meeting with the Likuni Community

Choice of Pump Technology

Water Works presented the Abakus pump using pictures and “The Abakus Component Manual” (prepared in the UK, prior to the project). The advantages and limitations of the Abakus pump were presented in comparison with the conventional reciprocating pump, the Malda pump, by means of pictures and discussions. The arguments in favour of the Abakus pump were that it could be built entirely by the villagers, using materials

found locally and that by choosing this pump, by far a cheaper option than the Malda pump, more projects could be implemented. Although the advantages of the Malda pump were presented, facts on other rural communities' incapability to perform O&M on this pump were also stressed.



Figure 3.2: Showing Digital Pictures of the Abakus and the Malda Pump

Agreement on the Pilot Project

It was agreed to do a pilot project on one well using the Abakus pump. After this pilot, a new meeting would be arranged to allow people to test the pump and make a decision on whether they would like to implement 4 more projects of the same type.

The aim of the pilot project was to teach well owners and users how to do the projects themselves. Water Works requested therefore that as many people as possible participate in the pilot, not only the well owner and his/her users. To facilitate this request, the Water Committee and the Village Head Men established a Project Committee with the responsibility to participate in the pilot and make decisions on behalf of the 8 villages. This Water Committee included 2 representatives from each village, at least one of whom a woman (see Appendix A.1 for more information on the Project Period organisational structure)

Site Investigation to Select the 5 Wells

After the initial meeting, the Water Works team and the Project Committee performed a survey on several targeted wells (chosen by Water Works based on the 2009 Likuni water census) to select the 5 wells of the projects. These 5 wells were chosen based on several factors: well sighting criteria for sustainable water points (Collins, 2001); the user population; and, last but not least, the user populations' demand for a project. This demand was demonstrated by the well users' enthusiasm for a potential project and the amount of materials they had managed to procure.



Figure 3.3: Inspecting a Targeted Well in Mchawa Village

In agreement with the Project Committee, 5 wells were selected. There was a unanimous agreement that the pilot project would run on Mr. Banda's well in Mtomondo, with a user population of 75 people. The start of the pilot project was scheduled on 1 September.

3.3.2 The Pilot Project: Upgrading Banda's Well in Mtomondo

Procuring Materials

The Likuni Water Committee had not managed to inform project beneficiaries about procuring materials for the pump as requested by Water Works

through a material list several weeks earlier. The only materials that had been collected were bricks and sand for the well protection.

Upon instruction by the Water Works team, Mr. Banda, Mr. Black and Alinafe, a local artisan, took charge of procuring the materials. Most of the materials, such as the timber, the pipes and the rope were procured at markets in Lilongwe and transported back to Likuni using local transportation. Some materials, such as the bicycle components, were found directly in Likuni or in local markets at walking distance. Portland cement for the well protection structure was bought from local markets in Lilongwe and transported to Likuni hiring a local truck. All the materials were bought by Water Works.



Figure 3.4: Transporting Timber Materials purchased at Local Markets on a Bicycle

Assessing Local Skills

There were sufficient local skills to perform the project. A project team of 4 locals with the necessary skills was established at the beginning of the project. This team consisted of Mr. Banda, the well owner, who was a trained builder, Alinafe who was a trained plumber, Happy who was a trained carpenter and Mr. Black who fell naturally in the role as the construction coordinator.

After simple demonstrations and through the use of pictures, Happy and Alinafe constructed the pump components in a far more professional manner than that had been done during the thesis research. Mr. Banda's building expertise was a great asset during the construction of the well protection. (See Appendix D for pictures of the construction)

The Construction Management

The Water Works team was predominantly responsible for construction management. This involved: demonstrating how pump components and the well protection should be built; setting up the list of materials to be procured and organising their transportation; task management; and time management. The reason for this extensive involvement in management on Water Works' part was that:

- It became clear at the beginning of the construction that information during the initial project meeting had been insufficient for the project team and the Project Committee to get a full understanding of the mechanisms of the Abakus pump. There was still a need for a detailed demonstration on not just how, but why certain pump components had to be built;
- Both the project team and the Project Committee held a traditional view that construction management was the external agency's role.

It also became clear that expecting the Project Committee to attend the building site full time everyday was unrealistic. Apart from contributing to gathering sand for the mortar and helping with building some of the well protection features, there were not enough tasks to keep all the committee members involved. On the other hand, the project team members, who were involved in the project 8 hours a day, needed an income as this involvement kept them from other activities. Halfway into the pilot project, it was therefore agreed that each member would receive a daily allowance of 500 MKW (£2.2), which corresponded to the local wage for a builder.

The Pump Performance

The Abakus pump was installed and under operation on 7 September, 5 days after the start of the pilot project. Although the discharge characteristics, of more than 40 litres per minute for a 9 meter deep well, were impressive the pump was relatively hard to operate by one person.



Figure 3.5: The Abakus Pump under Operation

3.3.3 The Inauguration of the Pilot Project

On 8 September the Project Committee and the Water Committee were invited to the inauguration of Banda's Abakus pump over a festive lunch sponsored by Water Works. Although neither the pump nor the well protection were fully finished, the pump was under operation. The Water Works team found it appropriate to organise a demonstration, to speed up the decision-making process concerning the 4 remaining projects. Two representatives from a partnering charity of Water Works, Action Aid Malawi, were invited to this inauguration to witness the demonstrations.

The Demonstration of the Pump

The presentation of the pump was performed by the project team, lead by Alinafe communicating in Chichewa. In his presentation, Alinafe carefully explained and demonstrated how the pump was built, what materials were used, and how the pump worked.



Figure 3.6: The Presentation of the Abakus by the Project Team



Figure 3.7: Alinafe Demonstrating how the "Guide" works

After the presentation, all meeting attendants were given the possibility to test the pump.



Figure 3.8: A Woman Representative of the Project Committee testing the Abakus

Decision Points

After the demonstration of the pump, a meeting was held with all attendants to make decisions with regard to the 4 remaining projects. Recalling the communication difficulties that had occurred during the first meeting of the project, Action Aids representatives agreed to do the presentation on Water Works' behalf in Chichewa. At the end of the presentation, the Project Committee was requested to make a decision on which type of pump it wanted for the refurbishment of the remaining wells. The options presented were the Abakus and the conventional Malda pump.

Understandably, arguments in favour of the Abakus pump were set forth. If the Abakus pump was chosen: more wells could be refurbished as this technology was much cheaper than the Malda; well users would be much better equipped to perform O&M because pump mechanisms were easy to understand; skills and materials were available locally; and for all these reasons, other well owners could potentially construct the pump entirely on their own. After an open discussion, the Project Committee voted to continue the remaining projects with the Abakus pump.

The last part of the meeting was devoted to select the 4 wells for the remaining projects. Water Works had prepared a list of 10 wells which was presented to Mr. Black and Mr. Banda. 2 wells were chosen during the meeting: Mr. A. Banda's well in Mnjolo and Ms. Eliet's well in Nkhongoni. Mr. Black explained that the remaining 2 wells were going to be selected the following week, based on who would have gathered most materials. All decisions were confirmed by the Project Committee.



Figure 3.9: Choosing Wells during the Meeting

Hygiene Education

According to the Project Period objectives, hygiene education was incorporated into the pilot project. However, as attendance by the Project Committee was low during the pilot project, hygiene education was rescheduled to the inauguration of the pilot project. The session on hygiene education was performed by Water Works, the project team (including the well owner Mr. Banda) and the Action Aid representatives.



Figure 3.10: The Hygiene Education Lead by Action Aid

3.3.4 Post Pilot Project Difficulties and Reassessment of Project Period Implementation Strategy

The start of the 2 new projects was scheduled on 10 September, with preparatory work for the foundation of concrete well protections. Water Works decided to postpone its involvement to 13 September, in order to test the project team's management capabilities. Up to that date, the tasks of Water Works had included inspecting other wells for potential projects and providing assistance in procuring materials. Until 15 September, the plan was to launch all 4 remaining projects, in order to meet the overall objective of completing a total of 5 wells by the end of the Project Period.

Due to a series of circumstances, however, this overall objective was modified. It became clear that it was unrealistic, and more importantly, that striving to meet this objective could actually compromise the overall aim of sustainability of the project. These circumstances can be summarised as follows:

- The social acceptance of the pump built during the pilot project diminished steadily in the Likuni Community in the days following the inauguration. This trend originated from two categories of factors presented in Appendix A.2. In short they were: an

- inadequate attention to the pump performance by Water Works during the pilot project; and social attitudes within Likuni;
- In order to implement several projects at the same time, the project team would need to be split up. However, it was recognised that efficiency, quality, and potential for innovation were a result of the project team working together;
 - Performing 4 projects simultaneously required a rigid time management strategy which did not incorporate unanticipated, but frequent events such as commitments to other activities, illness and death. During the Project Period of less than a month, the project was interrupted by four funerals.

A new Project Period strategy was therefore developed on 16 September. For the remaining period, the project team members would work together uniquely on one well, with minimum interference from the Water Works team. They would be given a completion deadline, but it was up to them how they were going to manage their time. The success indicators of this second project, in retrospect called the “second pilot project”, were that the project team would manage to plan and implement the project entirely by themselves, and would demonstrate that lessons learned during the first pilot were incorporated. If this was successful, Water Works would provide the materials needed to perform a total of 8 projects. Upon completion of the second pilot project, the Project Committee, but also the Village Head Men, would be invited for a second inauguration.

3.3.5 Second Pilot Project, Upgrading Mr. A. Banda’s well in Mnjolo

The second pilot project was performed by the project team under the management of Mr. Black on Mr. A. Banda’s well in Mnjolo. Due to his old age, Mr. A. Banda himself could not participate in the construction, but other well users contributed to the labour and material gathering. According to Mr. A. Banda, who was the Village Head Man of Mnjolo, his well had approximately 60 users.

The Role of Water Works

As mentioned, one of the main objectives of the second pilot project was to verify that the project team was capable of doing its own construction management. The role of the Water Works team in the Mnjolo well refurbishment was to inspect and monitor. Simultaneously to the second pilot project, however, a well protection was constructed in Chimphangu Village,

partially under the supervision of the Water Works team and Mr. Banda from the project team.



Figure 3.11: Women Gathering Sand for the Renovation of Mr. Chiphangu's Well

Considering that the total amount of projects had increased from 5 to 8, an important task of the Water Works team in this last phase of the Project Period was to make sure that the selected wells met the well sitting criteria discussed in section 3.3.1 of this report. Here, particular attention was put on making sure that the Village Head Men were agreeing on the wells chosen and that the user population of those wells demonstrated a high demand for improved water facilities.

As for the first pilot project, most of the materials were paid for by Water Works, but this time they were not purchased by the Water Works team. The project team members knew by then what materials they needed and where to get them locally, and therefore they purchased most of the materials themselves. This had an added benefit of getting the materials at a local price.

Assessing the Well Construction and Management

It took the project team 5 days to install the pump and complete everything but the roof on the well protection. Throughout this period the project team had shown an increased capability of independent and organised teamwork,

in addition to being capable of including the Mnjolo community in the construction process.

The pump was built with minimum interference from the Water Works team, which allowed the team to experiment with new materials and new solutions. The result was a pump with several new features such as:

- A new outlet: The outlet spout of the pump was originally designed as a rectangular box made of soft wood. The Mnjolo pump included a new outlet spout made of a locally fabricated pipe T-junction, designed by Alinafe (Appendix D) ;
- New pump handles: The main feature on the original design of the pump handles was bicycle pedals. On the Mnjolo pump, bicycle pedals had been replaced by bolts with nuts (Appendix D);
- A new rope system: The rope on the Mnjolo pump was much thicker than the Mtomondo pump, with the stiff bicycle tyre washers replaced by a much softer rubber from an old boot.



Figure 3.12: Alinafe and Happy Constructing the Abakus Pole System



Figure 3.13: Mr. Black Coordinating the Installation of the Abakus Shaft



Figure 3.14: Mr. Banda Improving the Grip of the Wheel with Rubber Bands

The Pump Performance

The Mnjolo Abakus pump was installed and operational by 22 September. This pump with well protection showed evidence of a project team that had acquired expertise and performed successful technology upgrades. Not only could the pump easily be operated by both women and children, the flow discharge parameters were also observed to be by far better than for the pump constructed during the first pilot project. In addition, the Mnjolo well appeared not only to be more resilient to wear; it was also more aesthetically pleasing than its precursor.



Figure 3.15: The Mnjolo Abakus Pump under Operation

3.3.6 Inauguration of Second Pilot Project and Signing of Contract

The inauguration of the second pilot project was held on 24 September in Mnjolo Village. This inauguration also marked the last day of Water Works' direct involvement in the project. The inauguration, consisting of a lunch sponsored by Water Works and a ceremonial meeting, was attended by the Water Works representatives, Mr. James Mambulu, the project team, the Water Committee, the Project Committee and the Village Head Men.

The Demonstration of the Pump

It had been observed for several days prior to the inauguration that Mr. A. Banda's pump in Mnjolo was very well received by the Likuni community. For example, Chimphangu Village, which originally had been sceptical about the Abakus pump technology because they believed that their children would not be capable of operating it, were now convinced that the pump would meet their demands after all. Similarly, villagers of Mtomondo asked for Mr. Banda's well to be upgraded in the same fashion as the new well in Mnjolo. As a result, the demonstration of the pump during the meeting could be characterised as a formality.

The Meeting and the Signing of the Contract

The main objective of the meeting was the presentation and the signing of the contract that had been prepared by Water Works and the Likuni Water Committee (Appendix B). In short, the contract comprised of four clauses. The first clause listed the 8 wells to be upgraded by the project. The second clause defined the standard required for each well upgrade. The third clause defined the responsibilities and obligations associated with the materials procured by Water Works for the project. The fourth and last clause defined the obligations associated with the monitoring of the project.



Figure 3.16: Signing the Contract

Post Meeting Activities

After the meeting a mango tree was planted next to each of the eight wells to be refurbished, as a symbol that the cooperation between the Likuni community and Water Works would continue.



Figure 3.17: Mr. A. Banda planting a Mango Tree next to his Well in Mnjolo

3.3.7 End of the Project Period

Prior to their departure on 25 September, the Water Works team had made arrangements with the Likuni community to confirm that they had the managerial and organisational requirements to perform the remaining projects without outside assistance.

The six projects were to be constructed by the receiving communities (users of the well) under the management and guidance of the Project Team (lead by Mr. Black) and the well owners. Upon completion of an upgraded well, the O&M of the well would be performed by the users of the well, under the management of the well owner. The role of the Likuni Water Committee would be to provide support to the well owner to meet his managerial obligations.

Recognising the important role of the project team in the construction of the upgraded wells and that their commitment to this task would prevent them from doing other jobs on a full time basis, it was agreed that of the 4 members in the project team would receive a lump sum each of 2500 MWK (£11) at the completion of each remaining 6 well refurbishments. This salary, funded by Water Works, would be granted by Mr. Mambulu after having confirmed that the well upgrading specifications have been met.

According to the agreement, the Likuni Water Committee committed to monitor the 8 projects. They would report back to Water Works, with assistance from Mr. Mambulu, at the end of every month for the next 10 months. The monitoring exercise consisted of filling out a monitoring form for each well every second week or every month, depending on whether the well construction was completed or not. A copy of the monitoring forms has been provided in Appendix C.

The materials procured for the remaining six projects were stored at the Water Committee treasurer's house, Mr. Banda. To keep track of the amount of materials used per well at all time (and thus the amount of materials in storage), a material monitoring system was set in place at the beginning of the second pilot project. This system was to be kept until the end of the project.

Before leaving, the Water Works team developed a new component manual of the Abakus pump, based on pictures taken and experiences made during the first Project Period. Several copies were given to the Water Committee to be used as a helping tool to teach other well owners and communities about the Abakus pump. A copy of the new component manual has been provided in Appendix D.



Figure 3.19: The Project Team and the Abakus Pump Designers

(From Left to right: Mr. Black, Christopher Mckeand, Mr. Banda, Mikael Ullero, Happy and Alinafe)

3.4 Assessment of Outputs from the Project Period

Several project milestones set prior to the start of the Project Period were reassessed or changed during that period. This was done because of the realisation that another project implementation strategy would be more successful than the initial milestones sett, in reaching the Project Period objectives. As a result, the majority of the objectives set prior to the Project Period were achieved.

The main change in the implementation strategy of the Project Period was the decision to organize a “Second Pilot Project”, where the rationale was to confirm that:

- The mechanisms of the Abakus pump were fully understood by the project beneficiaries in Likuni;
- The Abakus pump and the well protection could be built without outside assistance to a proficient level under the management of Likuni representatives, while empowering its community;

- These representatives were capable of adapting the pump technology and the project management to local preferences and needs.

Although in the short term the strategy change resulted in a reduction of the number of well upgrades from 5 to 2 during the Project Period, in the long term the total project output was increased to a minimum of 8 well upgrades.

3.5 Lessons Learned

3.5.1 The Controversy of Buying Materials

One important attribute of the Self Supply Management model is that the materials for the project have been financed and procured by the beneficiary of the project. Water Works had forwarded a list of materials to the Likuni Water Committee with the expectation that these materials could be procured before the start of the Project Period. However nothing was done. Whether the Water Committee had received the list, or simply not understood the assignment, remains unclear. In any case, only materials for the well protection, such as masonry and sand for the cement had been gathered by the Likuni communities.

Acknowledging that asking the community to procure these materials through their own means would take too much of the Project Period time, most of the materials for the pumps were bought by Water Works. For reasons of sustainability, however, the set prerequisites for these purchases were:

- That the location of the materials was identified and accessible by members in the community. Materials available in Likuni were preferred. For example, instead of purchasing timber logs from markets in Lilongwe, Water Works financed the felling of a pine tree in Chiphangu Village, in Likuni;
- Although the funding came from Water Works, the purchase itself was performed by members from the Likuni community;
- None of the pump materials was beyond the financial reach for any of the well owners.

3.5.2 The Underestimation of Social Acceptance of the Pump Technology

The social acceptance criteria that were taken into account under the initial design of the Abakus pump was that apart from being made using local skills and materials, it needed to be easily operated by women, as fetching water is primarily the role of women. One of the design features to meet this requirement was that the pump was built with two handles, so that the pump could be operated by two people.

In the weeks following the commissioning of the first pilot project, it was clear that several additional criteria should have received more attention in the design. These were as follows:

- Children should also be capable of operating the pump. It was observed that children from the age of 5 years were expected to fetch water for their families. These children could not operate the pump built during the first pilot project, partially because it was too heavy and partially because they could not properly reach the handles;
- The pump should easily be operated by one person only, as the pump was not operated by two people every time. Many pump users expressed discontent with the fact that the pump was too heavy to operate by individual users;
- The pump should be aesthetically pleasing. Some communities, such as the village of Nkhongoni, were not interested in the Abakus pump because they said that the pump "looked too local";
- The pump should be robust. This criterion was probably the most important with regard to social acceptance. In the days following the inauguration of the first pilot project several pump breakdowns occurred, with the rope slipping off the wheel or the handles losing their rubber grip. Although these breakdowns were minor and could be fixed within seconds, many pump users expressed discontent with this fragility.

One of the advantages of having a second pilot project was that social acceptance issues were given priority.

- The pump from the second pilot project was easier to operate, thanks to improvements in the design by the project team. Children could individually operate the pump;

- The project team suggested that Water Works should buy paint in the colour of preference of the well owners, to improve the aesthetics of the well protections;
- Thanks to the improved design, the pump from the second pilot project had far less minor breakdowns than the pump built during the first pilot project.

3.5.3 The Importance of including Village Head Men

Acknowledging the importance of the role of the women in water issues in rural African communities such as Likuni, only the Water Committee and the Project Committee (both groups comprising predominately of women) were directly invited to the inauguration of the first pilot project. Although not excluded from the meeting, the eight Village Head Men were not specifically invited, and therefore did not attend. Not having the Village Head Men at the meeting had serious implications. It was observed that in some villages, the Head Men convinced their committee representatives to change their mind about the decisions made during the meeting. Discussions with several Village Head Men and the project team members lead to believe that this behaviour was due to the following reasons:

- By not being included in the meeting, the Head Men were not properly informed about the intended project strategy unanimous agreement and the advantages of the Abakus pump;
- By not being included, they came to distrust the male members of the Water Committee Board and the Water Works team.

As a result of these observations, the Water Works team requested that the contract between Water Works and the Water Committee had to be approved by the Village Head Men. In addition, all Village Head Men were specifically invited to attend the second pilot project inauguration ceremony.

3.5.4 Working under Local Pace and Practices

As stated in section 3.3.4, two of the main reasons why it was not possible to perform four well upgrading projects simultaneously over a period of 10 days, were:

- That it was observed that the project team did not work efficiently unless they were working together as a team. Attempts made to divide the project team members to attend to several projects

simultaneously were unsuccessful. It appeared that the project team members were dependent on each other's inputs to perform their tasks proficiently and effectively;

- That time constraints would not accommodate commitments to other jobs and unanticipated events such as illnesses and deaths in Likuni. Besides, a rigid time management frame was not compatible with observed local work practices and would therefore have compromised the communities' ownership to the projects.

4. Conclusions

4.1 Conclusion of the Project Period

The Aim of the Master of Engineering Thesis was to introduce an alternative implementation model for handpump projects to Malawi's rural poor, which in theory would generate more sustainable projects, compared to conventional models. This new model, based on the Self Supply management model and an adaptation of the rope pump called the Abakus, was applied in three implementation phases: the pre-construction phase; the construction phase; and the post-construction phase. The initial implementation strategy, set prior to arriving at Likuni in September 2010, was based on this model. This strategy was:

- To teach well owners and their users how to manage the construction, operation and maintenance of their well upgrading during a pre-construction phase comprising an initial meeting and a pilot project;
- To have four well upgrading projects run simultaneously, managed and implemented by the well owners and their users, under guidance from the Water Works Team during the construction phase;
- To establish a system of monitoring of the commissioned projects, with regular reports to the Water Works Team in a post-construction phase.

As this report has demonstrated, the actual implementation strategy had to be modified when performed in situ, with an extension of the pre-construction phase including two pilot projects instead of only one. Also, the construction phase did not start until the last day of Water Works' direct involvement in the project, on the inauguration of the second pilot project, with a plan for six well upgrades to be performed by the Likuni community without outside assistance.

As has been argued in this report, this change in the implementation strategy increased the chance to reach the overall aim of the project: successful, sustainable hand pump projects for the Likuni villages. In this conclusion, this statement will be further justified by analysing the overall successfulness of the project following sustainability criteria defined as: the Sustainability Snapshot requirements; the demand for a project; and the created ownership to a project.

As expected in the Self Supply model, the community ownership to both pilot projects performed during the Project Period was high, as the pumps were built by people from the community using local materials and skills on wells which had originally been constructed from private initiatives. Still, the local ownership to the second pilot project was observed to be by far greater than to the first pilot project, because the construction management and the adaptation of the pump technology were fully performed by members of the local community without interference from the Water Works team. Indeed, the community's ownership to the two pilot projects increased at the rate to which the Water Works team's ownership decreased: The Water Works team's considerable involvement in the first pilot project revealed that their ownership to this project was high, which was demonstrated by the team's eagerness to defend the pump against criticism. Water Works' involvement in the second pilot project was significantly lower. The community took decisions and adapted the design of the pump without seeking the team's approval. As a result, Water Works gradually distanced itself from the project, which shows that its sense of ownership had significantly decreased. By then, it was the community who defended the pump against criticism from the Water Works team.

At the end of the Project Period, the SS requirements for the six remaining projects were also met. The Likuni community had shown evidence that it could perform the preventive maintenance of its wells, demonstrated by the fact that they had the skills and tools, knowledge and managerial capabilities to perform a well upgrade without external assistance. All materials needed to perform the projects had been identified and procured by the Likuni community, implying that they knew where to access spares. Although the Likuni community's capability of purchasing spare materials with its own funding was not fully tested during the Project Period, as most of the materials were funded by Water Works, none of the materials for the pump was deemed to be outside the community's financial reach. Certainly, the Likuni community's limitation from acquiring spare parts would not be a question of financial limitations, but more a question arising from the last important sustainability criterion: the demand.

One of the main reasons why the initial implementation strategy changed halfway during the Project Period was that the Likuni community's demand, demonstrated by their social acceptance of the pump, was diminishing. By extending the pre-construction phase with a second pilot project where social acceptance criteria were given greater attention, the demand for the project by the Likuni community was observed to be re-established. Still, it is precisely the lack of demand which represents the greatest threat to the sustainability of the Likuni projects. Surely, a community which every year is

under great risk of a cholera outbreak during the rainy season must have an undisputable great demand for well water protection. However, as demonstrated by the Village of Nkhongoni for instance which did not want the project because the pump did not meet the villager's aesthetical standards, this rational assumption may be disputable after all.

Recalling the "Spin-Off" effects resulting from performing the project in situ, proposed in the MEng thesis, it appears that several of these effects already have been achieved to various extents:

- The Likuni community has the capacity, competence and resources to perform the projects by its own initiative without external assistance;
- Already during the second pilot project, improvements were performed on the pump technology;
- By specifically using materials available within the Likuni community, such as bicycle components, masonry and timber, in time this may boost the local economy in Likuni.

4.2 Indications from the First Round of Monitoring

The monitoring reports for September were sent to Water Works by fax by Mr. Mambulu on 15 November. These reports indicated that a total of 4 well upgrades were operational, which means that two well upgrades had been terminated in the month of September (Mr. Chiphangu's Well in Chiphangu and Mr. Mgnona's well in Mtomondo, serving 70 and 60 people respectively). Mr. Mambulu's side comments on these reports indicated that the project team and the well beneficiaries had had other commitments, which had prevented them from working at a greater pace.

The reports also indicated some difficulties with the rope. For all pumps except one (Mr. Mgonu's well), the rope had been changed at least once since its commissioning. In his feedback on the reports, James Mambulu informed that the project team were currently working on a design solution which aimed to minimise the abrasion (leading to rupture) on the rope. No news on this design has been received at the time of writing.

Considering that the monitoring information at hand was for only one month of project it would be of speculative nature, at the time of writing, to draw conclusions on the overall successfulness of the project. However, considering that it only took 5 days to complete the second pilot project, Water Works expected, understandably, a higher number of well refurbishments during

September. Whether this delay is due to a lack of demand for the project or simply, as commented by Mr. Mambulu, to other commitments in the community, will be confirmed when further monitoring reports are received. In total, monitoring reports are expected every month including May 2011, where the reports for November are expected in mid December 2010.

4.3 Future Projects from Water Works in Likuni

An additional incentive given by the Water Works team to the community of Likuni to perform the 6 projects was that if the community would perform the projects successfully according to the agreement, the likelihood of a continued cooperation between Water Works and the 8 Likuni villages for the summer of 2011 would be high. This cooperation would include further well refurbishment projects, but also sanitary projects. However, if the 6 projects were unsuccessful, the likelihood of a future cooperation would be low. In this case, Water Works would rather seek to perform the projects in Malawian rural communities with a stronger demand. Such communities have already been signalled to Water Works by two partnering Malawian charities: Fresh Water Project; and Action Aid Malawi.

Regardless of the overall successfulness of the project however, and given the importance of following up the sustainability of the project outcomes, with regard to Water Works' current research on water point sustainability, Water Works and the Likuni Villages will certainly remain in contact at least during the next 1 ½ - 2 years.

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Appendix A

A.1 Project Period Organisational System

The Water Works Team

The Water Works team consisted of 4 volunteers in charge of implementing the project strategy during the Project Period. The volunteers were Simon Cohen, Jannik Woxholth, Christopher Mckeand and Mikael Ullerø.

The Likuni Water Committee

The Likuni Water Committee was the established committee dealing with all water related issues in the 8 villages of Likuni. It was the Likuni Water Committee that requested the Likuni Water Development Projects in 2009 and that performed the Likuni Water and Sanitation Census. The Likuni Water Committee consists of 11 members: Mr. Black (Chair), Mr. Banda (Treasurer), Ms. Eliet (Secretary) and one representative of each village.

The Project Committee

The Project Committee was established specifically for the Project Period. This committee of 16 included 2 representatives from each village, of which 10 were women. The Project Committee representatives were elected by the Likuni Water Committee and the Village Head Men to take part in the construction of the first pilot project and to make decisions on the behalf of all villages with regard to the projects.

The Project Team

The Project Team consisted of 4 members from the Likuni Villages possessing specific skills needed to implement the projects. Mr. Banda was a trained builder, Alinafe Kuzemba was a trained plumber, "Happy" was a trained carpenter while Mr. Black (the Water Committee Chair) was a construction coordinator. After the Project Period, the intended role of the Project Team was to take charge of the construction management for the remaining projects.

The Village Head Men

The Village Head Men are the chiefs from each Village in Likuni.

A.2 Social Acceptance of Mr. Banda's Well in Mtomondo

During the meeting held on the first pilot project inauguration, a uniform decision was made by the Project Committee (the elected representatives of the 8 villages) to use the Abakus pump technology for the remaining well refurbishments. But only a few days later, many of the representatives had changed their minds on this decision. In Chimphangu, for example, the representatives were sceptical about the performance of the Abakus pump over time, and therefore requested an upgraded family well (a shallow well protection with a rope and bucket) with the possibility of installing a pump at a later stage. In Nkhongoni, the village head man had convinced the two representatives that the Abakus technology was too "local" and that they wanted instead a modern borehole with an Afridev pump.

The rationale for the diminishing social acceptance of the pump in the wake of the pilot inauguration can be grouped in two categories of reasons: an inadequate attention to the pump's serviceability and durability by the Water Works team; and social attitudes within Likuni (distrust within the community, ignorance among several Likuni Village Headmen.)

Inadequate Attention to the Pump's Performance by Water Works

- Some villagers, especially people who did not attend the inauguration meeting, did not accept the pump because they thought that the well presented at the inauguration was a final product. When the pump was presented and demonstrated on the inauguration, neither the pump nor the well protection were fully completed. The well protection had not been plastered with mortar, and neither the pump cover nor the platform for people to stand on while operating the pump were installed yet. On the pump, the handles had not been fastened properly and had not been adjusted to the users' height;
- The pump had not been adequately tested over time before it was presented to the community on the inauguration. This resulted in several unnecessary episodes of early breakdowns of the pump in the days after the inauguration;
- The Water Works team had underestimated the importance of the pump's ease of operation. Although the pump was easily operated by two people, operating the pump individually, especially for some of the women, was expressed to be difficult. Even more importantly, the Water Works team had not envisaged that children as young as 5 years old were expected to operate the pump. This

latter requirement was one of the main reasons why the villagers of Chimphangu, for instance, became sceptical about the Abakus technology;

- In addition, the Water Works team had not anticipated that the pump, being a novelty in the village, would suffer excessive wear from children using it as a playing ground in its first days of operation, without any intervention from adults to protect the pump's site.

Social Attitudes within Likuni

The request from the Nkhongoni Village, lead by the Village Headman, of having a borehole installed with an Afridev pump was denied by the Water Works team. As was explained, drilling a borehole in an area with high water table was unnecessary. Also, a project of such calibre would engulf the remaining project budget. More importantly however, the request was denied because this would violate the democratic decision made by the Project Committee during the project inauguration meeting.

This episode with Nkhongoni Village was a demonstration of several social attitudes observed in Likuni. First, the request reflected the belief that Water Works, a foreign western agency, had limitless funds. It also seemed to reflect a mindset that "one has the right to receive". Second, the request demonstrated distrust within the community. The village Headman of Nkhongoni was convinced that the project team was promoting the cheaper pump technology because it intended to pocket the project overheads. In spite of the Water Works team's attempt to clarify these misunderstandings, no satisfactory solutions were found, and both parties agreed that Nkhongoni would not benefit further from the project.

Appendix B: The Likuni Water Development Project Contract

Agreement

Between

Likuni water Committee

And

Water Works Charity

Regarding the upgrading of the following wells in the Likuni Area:

<u>Village</u>	<u>Well Owner</u>
Mtomondo	Mr. Banda
Mnjolo	Mr. Banda
Chimphangu	Mr. Chimphangu
Kulambala	Mr. Tito
Nachipi	Mr. Tifele
Chitsinde	Mr. Henerry
Mtomondo	Mr. Mgone
Nachipi	Mr. Adiyele

1. Definition of the well upgrading

All the wells are to be upgraded in the same fashion as Mr. Banda's well in Mtomondo or Mr. Banda's well in Mnjolo. This includes both the building of well protection and by the making of an Abakus Rope Pump.

In case villages do not want the pump to be installed, it could be sufficient to start by building the well protection. Materials should be saved to install the pump at a later stage if wanted by the village.

2. Materials

The village should itself provide as much materials as possible. Remaining materials are provided by Water Works in cooperation with the village and the Water Committee. If not otherwise agreed, the village should at least provide bricks and sand.

The Water Committee, represented by Chairman Mr. Black, is responsible for the materials provided by Water Works. The materials should be stored in a secure place and the signature of both the Water Committee Treasurer and Water Committee Secretary is necessary to obtain stored materials for usage.

The materials provided by Water Works should only be used for the upgrading of the above mentioned wells. The materials cannot be used for any other purpose.

Any materials not used for the upgrading of the above mentioned wells should be stored in a safe place and returned to Water Works as soon as possible.

The list of materials provided by Water Works Charity is presented in Appendix A.

3. Monitoring

The water committee, represented by Chairman Mr. Black, is responsible for filling in monitoring schemes provided by Water Works. For wells under construction, schemes should be filled in every second week. For finished wells, schemes should be filled in every month. When filled in, the schemes should be handed to Mr. Mambulu. The Likuni Water Project monitoring should start on Monday the 4th October, 2010.

I hereby agree to the above mentioned terms of this agreement

Likuni Water Committee

Place/Date:

Mr. Black



Chairman

Water Works Charity

Place/Date:

Mnyolo Village, 24/09/10



Mikael Ullero

Water Works Project Coordinator

APPENDIX A: List of Materials and Tools Provided by Water Works Charity for the Likuni Water Projects

Materials	Unit	Amount per project	Total amount for 8 projects	Procured before 22/09/10	Procured after 23/09/10
Portland cement	50 kg bags	7	56	20	36
32mm PVC pipes	6 metre	2	16	8	8
Posts (and stiffener), soft wood	6m 11cm*4.5cm	2	16	8	8
Rope, 8mm	1 metre	30	240	110	200
Guide, timber logs	per log	1	8	2	6
Rubber strips	per strip	5	40	20	20
Shafts, hard wood	2m 2in*2in 80cm	1	8	4	4
Hub, hard wood	1in*6in	1	8	2	6
Handles (and hub stiffener), soft wood	2m 2in*4in	1	8	1	7
Roofing, soft wood	14m 2in*2in	1	8	2	6
Nails 2 inch	per kg	0.25	2	NA	2
Nails 3 inch	per kg	0.25	2	NA	2
Screws 2 inch	per box	0.25	2	NA	2
PVC fittings for outlet spout	per bulk	1	8	1	7
Bolts and nuts for handles	per bulk	2	16	2	14
Solvent cement PVC	per bottle	0.5	4	1	3
Wood glue	per bucket	0.5	4	1	3
Grease	per bucket	1	8	1	7
Super glue	per tube	0.5	4	0	4
Lime	per packet	2	16	2	14
Paint	5l bucket	0.375	3	1	2
Wood varnish	per bucket	0.375	3	1	2

Materials Not Provided by Water Works

Bricks and sand
Bicycle wheel
Rubber for washers
Spokes

Tools	Unit	Total amount for 8 projects	Procured before 22/09/10	Procured after 23/09/10
Chisel	per item	5	2	3
Sandpaper, coarse	per sheet	8	8	0
Sandpaper, fine	per sheet	5	5	0
Pens	per item	5	0	5
Paint brush	per item	8	2	6
Spirit level	per item	1	0	1
Wood saw	per item	1	0	1
Hack blades with handle	per item	1	0	1

Appendix C: The Likuni Water Development Project Monitoring Forms

Likuni water project monitoring scheme

To be filed in by the hand handed to Mr. Mubidu every second week starting from 11th of October 2019

Date: _____ Day: _____ Month: _____ Year: _____

Well: _____ Village: _____ Well owner: _____

Activities of the owner	Finished	Not yet finished	Not needed for this well	Not finished, date
Make the poles and attach them to the stirrer				
Place the poles with the stirrer in cement				
Make the guide				
Make the shaft				
Make the wheel				
Attach the wheel to the shaft				
Make the handles				
Make the rope with knots and washers				
Attach the rope to the guide				
Place the guide in the well				
Make the outlet spout				
Attach the outlet spout to the well				
Attach the handles to the shaft				
Attach the shaft on the poles				
Assembly of all parts, finishing of drum				
Making of the well protection	Finished	Not yet finished	Not applicable to this well	Not finished, date of completion
Gather bricks and sand				
Put a ring around the well - 2 bricks wide and at least 100cm deep				
Cover the bottom of the ring with a layer of cement				
Build the well wall with bricks				
Make the drainage channel with plaster				
Make plaster around well with plaster				
Plaster well wall				
Build the well roof				
Landscaping to a ground around the well to make sure rainwater flows away from the well				
Make fence around the well				
Make gaps in the fence to let well users hand keep animals out				
Finishing of the well protection				

Well protection and completed

Please specify why the well protection is not finished:

Completion

How many bags of Portland Cement were used for the well:

If more than 7 bags of cement were used, please specify why:

Any additional comments:

Likuni water project monitoring scheme

To be filled in by Mr. Black and handed to Mr. Mambulu every month starting from 4th October 2010.

Date	Day:	Month:	Year:
	<input type="text"/>	<input type="text"/>	<input type="text"/>
Well	Village	Well owner	
	<input type="text"/>	<input type="text"/>	

Operation of well and pump

1. Is the pump working?

If no, answer question 2 to 3
If yes, answer question 4 to 7

YES	NO
-----	----

2. Which part(s) of the pump broke and why?:

3. Will the pump be repaired?

If no, please specify why:

YES	NO
-----	----

4. Has any maintenance been done on the pump in the last two weeks?

If yes, please specify what:

YES	NO
-----	----

5. Has the pump broken down in the last two weeks?

If yes, which part(s) of the pump broke and how was it fixed?:

YES	NO
-----	----

6. How many people are currently using the well?

7. Are people happy using the well?

If not happy, please specify why:

Not Happy	Happy	Very Happy
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Appendix D: The Abakus Manual