SKAT

Swiss Centre for Development Cooperation
in Technology and Management

Performance Evaluation of Handpumps used in UNICEF Projects

Erich Baumann, December 1993

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Executive summary

UNICEF WES programmes in the 4 visited countries vary considerably. They have however one common denominator: They were (or are) not integrated in the overall policy of the countries. (A reason why this was not done in the past might be that the national sector policy was not existent). In Burkina Faso, Mali and Benin the projects are not substantial enough to dominate the sector and to formulate the sector strategy. Nigeria is a special case and would need to be looked at separately.

UNICEF's approach to carry out the drilling operation for the governments and to provide materials (including handpumps) purchased through the supply department in Copenhagen has done little to enhance the capacity in the local private sector to maintain the constructed water points. It has however achieved one thing, it provided safe water to many beneficiaries. In Burkina, Mali and Benin UNICEF has built about 3,500 water points and fitted them with INDIA MKII pumps. If compared to other projects, UNICEF projects were more cost effective and had a quality standard that was above average. They also benefitted from the fact that with the India MKII a handpump was chosen that performs well.

Currently UNICEF is cutting back its involvement and has started to adopt the national sector policies. In the past very little self sustained structures to support the communities were established. New community managed projects concern themselves mostly with new water points. The introduction of this philosophy holds the danger that the old water points will be left without the necessary support. UNICEF's future projects should consider the past and have a strategy built in that allows to support these infrastructures. Further it would make sense to look back on the achievements of the last decade, to assess what had been working well and than base future projects on these perceptions.

Handpumps have been glorified and mystified in water supply projects. A fact is that the choice of a bad handpump can make a badly designed and executed project a disaster. The choice of a good handpump would make the same project not much better. During the last 20 years handpump designs have been improved. Several sound handpump types are available that can provide a good service. Debacles that are still sometimes experienced. They happen because projects are jumping the gun and employ unproven technology in large scale.
The question whether a pump can be maintained by the communities does not depend on one or two specific design features but on the willingness of the community to keep the pump operational. (After all, the reason that a bushtaxi is still operational after 25 years of use and abuse does not depend on the fact that a car can be repaired with a few simple tools but on the fact that is considered essential and on the availability of spare parts). Water from a handpump is not always conceived as a crucial need in the villages. Therefore handpumps are often not repaired. The best way of convincing communities about the importance of their water point is to attach some economic activities around the water point (sales of water for animals in Mali or gardening in Benin are examples). Such pumps provide an immediate economic return are therefore kept operational. Spare parts and back up services are available for this, the type of pump that is being used is of less relevance. Important elements for the acceptance of a pump are high yield, reliability and ease of operation.

The scope of the mission was to assess how pumps utilized in UNICEF projects perform

under the given conditions. The types used are India MKII, India MKIII, Vergnet and UPM. Of these types the Vergnet, UPM and India MKIII are relatively new to UNICEF projects. The India MKII had been used for many years. The operating conditions determine to a large extent whether a pump is best suited. The conditions have been categorized as follows:

less than 45 m lift, non- aggressive water	less than 45 m lift, aggressive water	over 45 m lift
The India MKII or MKIII are by far the cheapest and the best suited choice. Of these the India MKIII is easier to maintain. Vergnet, UPM and Kardia do not offer any substantial advantages. They are more expensive and their yield is lower.	The cost advantage of the India MKII and especially of the India MKIII over the other types diminishes. The India MKII with the light SS rising main can be dismantled without any lifting tackle. The MKIII is much more expensive and offers very little advantage during maintenance. The PVC rising main for the MKIII have not yet been tested in large scale, this development should be followed carefully. The price difference between the India MKII and the Vergnet or UPM is minimal. The choice of pump might under this conditions best be governed by the availability of after sales services and the aspect of yield.	If water needs to be pumped from more than 45 m the operating conditions for handpumps are unfavourable. India MKII/MKIII and Vergnet are not really suited. The UPM can be utilized as it allows the sharing of the work by several people. Communities will need financial and technical support to maintain a handpump installed at this level. Alternative technology for pumping might be considered.

Taking these findings into account there is no need for UNICEF do not change its choice of handpump types. UNICEF has been using India MKII pumps with good results for the last 12 years in West Africa. Other types (Vergnet, UPM) do not have any significant advantages. It can be recommended to carry on using India MKII and MKIII pumps in its projects if the installations are not too deep. For installations of 45 m and more handpumps should only be used if other options are not considered feasible. If a handpump is used in this conditions the UPM seems to be a feasible option.

The choice of handpump technology should however be governed by the situation in the country. If an other type of pump is prevalent and a functioning service network has been established it would make sense to purchase the same pump.

However it is strongly recommended to change the policy of procurement. If the pumps are purchased locally UNICEF can be instrumental in maintaining or setting up local capacity to produce and maintain the pumps. Local representatives of imported pumps or local manufacturers should sell the handpumps including delivery and installation, training of area mechanics and village pump care takers, guarantee, supply of spare parts and technical back up. The initial cost of the pumps will be higher than for pumps purchased in bulk from abroad. The benefits from such a procurement policy are that on local level private enterprises will provide services that are not dependent on one project only. The

initially higher cost for the pumps will be by far outweighed by the savings gained through local capacity building.

In all African countries a vast amount of money lies idle. Hundreds of expensive boreholes are not utilized because the handpumps are broken down. A borehole should have a service life of 25 years and more. Handpumps need to be replaced after about 10-12 years. Many of these boreholes could be rehabilitated for relatively small sums. It is therefore highly recommended that UNICEF includes the refurbishing of old boreholes in their projects. Since most of the UNICEF boreholes were fitted with India MKII pumps it would make sense to salvage as much as possible from the old pumpheads and cylinders. Such an action would again make the involvement of local suppliers useful as it is difficult to plan the amount of material needed.

Abbreviations:

	General
CRL	Consumers Research Laboratory
ICB	International Competitive Bidding
LCB	Local Competitive Bidding
VAT	Value Added Tax
VLOM	Village Level Operation and Management of maintenance
	Burkina Faso
ADRK	Association pour la Developpement de la Region de Kaya
CIEH	Commite Interafricain d'Etudes Hydrauliques
CPE	Commite de Point d'Eau (Village Water Committee)
CNPAR	Centre Nationale de Perfectionnement des Artisan Ruraux
DEP	Direction des Etudes et Planification
DRE	Direction Regional de l'Eau
6me FED	Fond European de Developpement, Phase 6
ONEA	Office National de l'Eau et de Assainissement
ONPF	Office National de Planification des Forages
OPEP	Organization of Petrol Exporting Countries (OPEC)
PEDI	Project Programmation et Execution du Developpement Integre
PPIK	Project Parentage International de Karakaya
SFC	Safe the Children Fund
	Mali
CM	Consulting and Management, (Italian Project)
DNHE	Direction Nationale de Hydraulique et Energie
GOM	Government of Mali
PAGA	Project Appui des Groupes d'Autopromotion
PHR	Project Hydraulique Rural, Bandiagara (Catholic Church)
	Nigeria
ADP	Agricultural Development Programme
DFFRI	Directorate for Feeder Roads and Rural Infrastructure
FMWAI	Federal Ministry of Water Resources, Agriculture and Infrastructure
LGA	Local Government Administration
RUWATSAN	Rural Water and Sanitation
	Benin
BOAD	West African Development Bank
DH	Direction de Hydraulique
FED	European Development Fund
GOB	Government of Benin
JICA	Japan International Cooperation
SBEE	Societe Beninoise d'Eau et d'Electricite
WB	World Bank

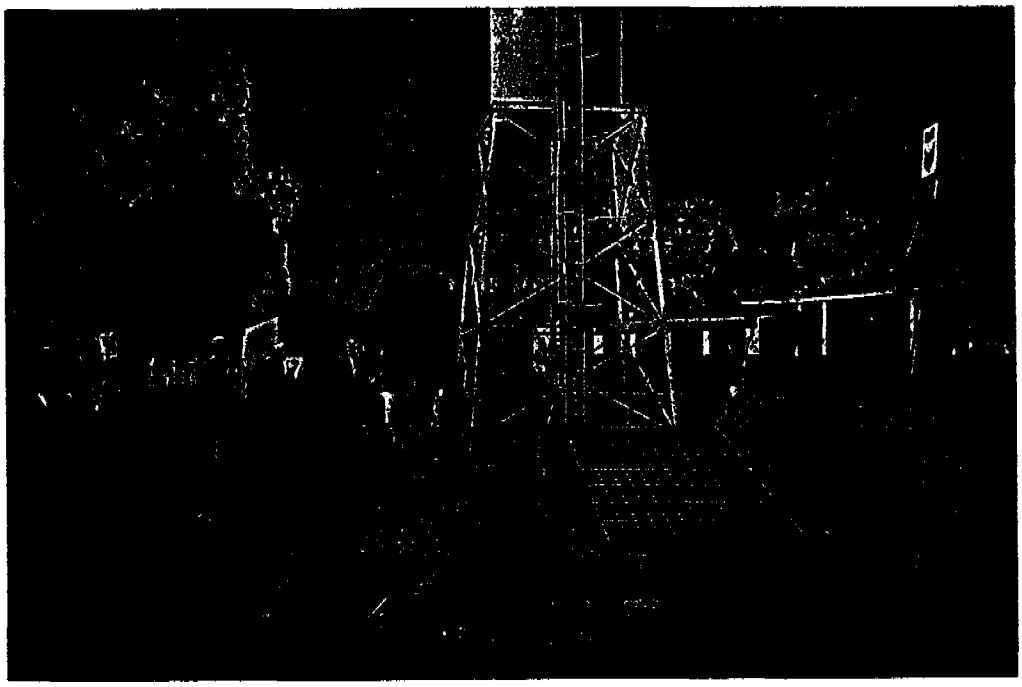

Figure 1 Solar pump in Mali

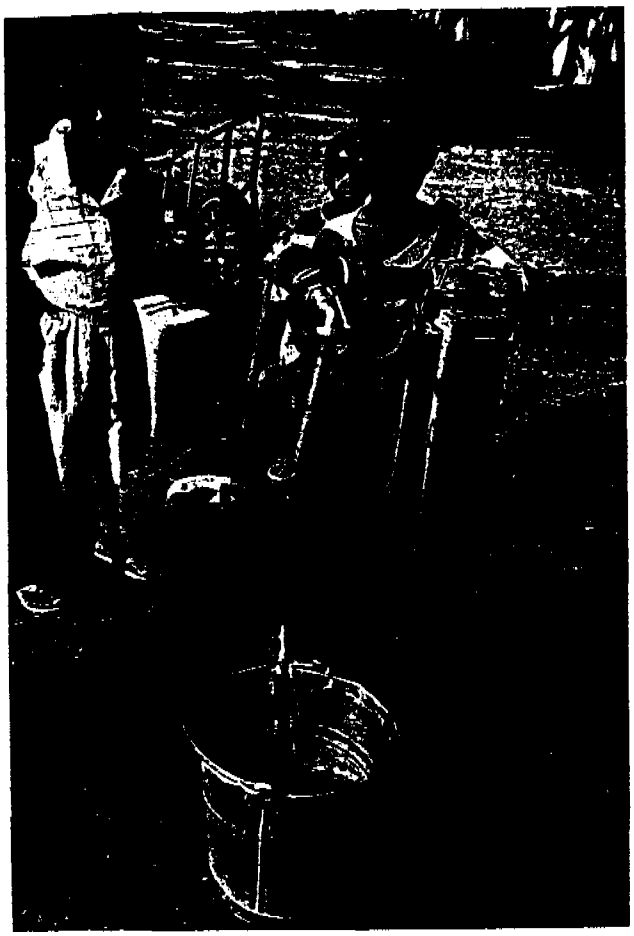

Figure 2 A water point with a high yield is what the users would like to get

Figure 3 What they get in reality looks different.

1. Introduction

Every year UNICEF WES projects are purchasing large numbers of handpumps. The promotion of low cost technologies by UNICEF has had a profound impact on the implementation of the projects. UNICEF has followed the policy to standardize the types of pumps used. In some countries that achieved total self-sufficiency in production of handpumps the standardization policy has been acclaimed as the reason for the success. Recently standardization has been criticized for restricting free market forces and suppressing the development of local private industries in smaller countries.

Community management (VLOM concept) under which the beneficiaries take full responsibility for O&M of their water points was introduced to relieve the governments from the day to day interventions in the maintenance. Handpumps (their reliability, robustness and ease of repair) are one important element in the concept. The VLOM concept depends not only on technical factors. Its effectiveness is also determined by social, cultural, economical and institutional aspects. It requires a change in attitude in the communities which can only be achieved through extensive training. The villages on their part depend on an effective after sales service structure. Spare parts need to be made available to communities in the regions. A technical back-up organizations is needed to support the communities when the severity of breakdowns exceeds their capacity. Regardless of what pump type is used it will only perform satisfactory if a suitable maintenance scheme and provision after sales services have been implemented.

The scope of this study was to collect data on handpump performance in several countries in West Africa. UNICEF WES projects vary in design and execution from country to country. Projects in Mali or Burkina Faso operate in a completely different environment then in Nigeria. Accordingly the findings and the recommendations contrast for each country. It is however also possible to find common denominators about the factors that influence the performance of the pumps. These collective aspects should be considered for the formulation of future strategies.

The basis for the judgement of the performance of handpumps should be unbiased data that takes into account the prevailing operating conditions. After all the overall objective is to provide rural communities with handpumps that are adapted to their specific needs, of good quality and can be maintained by them.

2. Country Reports

2.1 Burkina Faso

2.1.1 Country Information

Burkina Faso has approximately 22,000 modern water points of which about 16,000 are boreholes with handpumps. 6,000 water points are improved hand dug wells. This represents a coverage of about 70% of the population with access to safe water. Because of the hydrogeological conditions the construction of hand dug wells is difficult. The emphasis of the construction work has recently has been placed on boreholes with handpumps.

Since 1989 Burkina Faso is divided in 10 regions. Each of the region (which can include 2-3 provinces) had a DRE established. The DRE is responsible for the planning of the construction

work in its region. The DRE's are not regularly funded by the government. They have to try to attract donor funded projects to finance their activities.

Burkina Faso has about 30 different handpump types. The following are the most commonly used types:

5,000	ABI MN and DIAFA
2,000	India MKII
1,500	Kardia
1,800	Vergnet
1,000	Volanta
300	UPM
300	Pulsa
500	Moyno

The Moyno pumps were installed about 15 years ago and will be replaced under a rehabilitation project financed by OPEP. The Pulsa pumps never really worked and are to be replaced. DEP tries to realize some kind of standardization in Burkina Faso by recommending regional standardization.

Construction work is now mostly done through local competitive bidding. The work for siting, drilling, pump installation is contracted separately to private companies. ONPF (the government drilling unit) has now to operate like a commercial enterprise and to participate in LCB. Handpumps are normally supplied through the local representatives of the manufacturers from abroad or through the local manufacturers. Three local companies produce handpumps in Burkina Faso:

India MKII	APICOMA in Ouagadougou
Volanta	St. Famille in Saaba
DIAFA	DIACFA in Ouagadougou, (of the latter the local production could not be verified)

All major handpump suppliers are represented in the country. The representatives have all their headquarters in Ouagadougou (except for St. Famille):

National policy for operation and maintenance is that the beneficiaries communities have to take full responsibility for the maintenance of the pump. Normally the communities do not have to contribute towards the construction cost of the water point but need to have collected between 50,000 to 75,000 FCFA for future repairs. Each community has to form a water committee (CPE) which consists normally of 7 persons (Chairman, secretary, treasurer, 2 hygiene workers, 2 pump caretakers). The hygiene workers are normally women, their responsibility is to keep the pump surroundings clean. The other members of the committee are normally men.

Artisan Reparateurs (field mechanics) are commonly trained either by the representatives of the handpumps or by the projects themselves. They are issued with a toolbox and normally do not receive any means of transportation. It is not common that the mechanics also sells spare parts. The mechanics usually help to install the pumps for which they get paid. This is part of their training. Later on they work completely independent. Several hundred mechanics have been trained over the years. By now new projects and rehabilitation projects tend to recruit mechanics that are already working in the area and to retrain and re-equip them.

Spare part supply is left entirely to the private sector. All pump suppliers are required to establish regional sales outlets for spare parts.

2.1.2 **UNICEF Programme**

UNICEF has been drilling about 1,500 boreholes over the last 10 years. UNICEF policy had not varied from the national policy with the exception that UNICEF had been operating its own drilling team. Since about 1992 UNICEF has stopped drilling by themselves. LCB was launched for the construction of boreholes. A hydrogeologist is supervising the operation carried out be various contractors. Presently UNICEF drills about 40-50 new boreholes per annum. The pumps used in the UNICEF programme were India MKII (either from India, Mali or from local production, APICOMA). Since 1993 UNICEF is using Vergnet and UPM pumps.

Together with a Dutch funded project UNICEF is in the process of establishing a database of all water points in Burkina Faso. This is done in connection with the Guinea Worm Eradication Programme. The collection of data has been completed but not yet analyzed.

2.1.3 **Field Trip Impressions**

The following regions were visited:

DRE de Centre North, covering the provinces Bam, Samnatenga, Namentenga
DRE de Sahel, province Sahel
DRE de North, covering the provinces Yatenga, Pasore and Sourou

Due to the restriction in time (vehicle breakdown) it was not possible visit a large number of pumps sites. Data about the pump installations were also not always available because the variety of projects. It was however possible to capture the sense of the real situation in the field which seems to differ considerably from the picture that is created in the capital city.

The pumps visited were 3 weeks to 12 years old. The type of pumps visited were India MKII, ABI MN/DIAFA, DUBA, Vergnet. Details about the visits can be seen in ANNEX IV.

2.1.3.1 **Operating Conditions** in the visited provinces:

General:

Construction of water points had been uncoordinated for many years. Borehole were drilled under all kind of programmes (emergency programme after the drought, etc) by various projects. The DRE's have only been established 3 years ago. They have incomplete data of the installations made before their time. And as matter of fact they also have incomplete data of what had been going on since their invention. Many villages have several boreholes installed, many have two or three different handpumps types in the village. It appears that the situation in Burkina Faso will remain confusing for some time to come because of the absence of directives and the complete financial dependency of the DRE's on the support given by projects.

Hydrogeology and water quality:

The pump installations are generally deep to very deep. The cylinder setting varies between 30 to 70 m. The water is not aggressive in the northern part of Burkina Faso (with the exception of some pockets). Therefore the use of corrosion resistant pumps (stainless steel, plastic rising main) is not imperative. This is however not true for the south of the country (near the border to Ivory Coast and Ghana) where aggressive water is prevalent.

Acceptance criteria for boreholes (in the UNICEF projects) is 700 lt/h. This means that normally the yield of the borehole is sufficient to allow continuous pumping.

Usage:

The economic activities in the villages concentrate on farming. They are governed by the rainfall pattern: rainy season June to September and very dry and hot from October to May. This allows only one crop during the rainy season for the rest of the time livestock farming is dominant. This means that during the dry season the water from the handpump has to be shared between humans and animals. During the rainy season it is however still common that alternative sources are used. This using pattern causes that pumps can have a high demand in peak times with long queues waiting. Therefore the yield of a pump is an important factor for its acceptance in the community.

2.1.3.2 **Pumps**

Breakdown Rate

The information of how many pumps are actually operational vary considerably. The lowest figure was quoted by Safe the Children Fund. They claim that as little as 20% of the pumps are working in the Sahel province.

ONPF estimates the figures of operational pumps to be around 60-65%.

The Director of the DRE in Ouahigouya stated that 98% of all the pumps in his area are operational. This latter figure could not be verified. It appears that since the Yatenga province has always been an advertising ground for Vergnet and the community managed approach that this figure is grossly over optimistic.

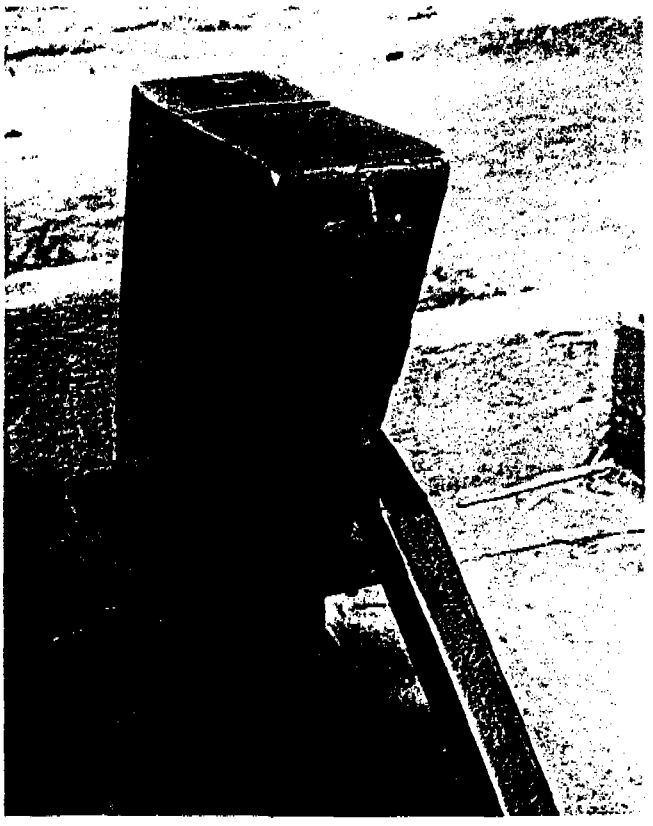

Figure 4 A pump that is still giving water would be considered operational. Regardless of the need fro repair.

A Dutch evaluation examined 58 pumps in 1992 and found:

47 Nos India MKII with an average age of 3.8 years 78.3% were operational
11 Nos ABI MN with an average age of 3.5 years 54.5% were operational
The pumps that were in operational condition have had 0.74 repairs per annum.

The results from the Dutch funded database which is presently analyzed by UNICEF are as follows:

Table 1:

Pumptype	Average Age	No Operational	No Broken down	% operational
ABI	5.85	3258	1040	75.8
India MKII	4.67	1689	362	82.4
Moyno	8.12	162	169	49.0
Vergnet	5.16	905	178	83.5
Kardia	5.18	685	66	91.0
Volanta	4.00	923	224	80.5
Diafa	2.99	1268	228	84.7
Pulsa	5.13	172	164	51.2
TOTAL	5.14	9082	2431	78.8

Note: The database does not distinguish between pumps that are in need of repair or pumps that are in good shape. If water is still coming out they are considered operational. Therefore a figure of 78.8% pumps being operational is somewhat misleading.

India MKII: The pump performs satisfactory under the given conditions. It is robust, repairs are normally minor. Piston seals, bearings and chains have to be replaced regularly as they are wearing parts. If this is done the pump can provide good service for many years. It is easy to operate and has a relatively high yield. Since the pump is now made in Burkina Faso the problems with spare parts can be overcome.

At installation depth of more than 40 m it is difficult for the area mechanics to intervene when they have to lift the cylinder and the rising main. Also at this depth the pump is becoming increasingly heavy to pump. The 2" cylinder version with a counter poise at the lever is not used in Burkina Faso.

It is relatively cheap, price from APICOMA exclusive VAT FCFA 140,000.- at 0 m (price without rising mains and rods). Imported pumps from India are even cheaper.

ABI MN/DIAFA: The ABI MN and the DIAFA have similar characteristics like the India MKII. The replacement of the plastic bearing can easily done by the area mechanic. The DIAFA pumps has had considerable problems with cracking of cylinder sleeves. The manufacturer now claims that these problems have been solved.

At a price of FCFA 220,000.- at 0 m (exclusive VAT) it is considerably more expensive than the similar India MKII.

Vergnet: The Vergnet pump works satisfactory under the prevailing operation conditions. It is easy to maintain by an area mechanic. A negative point is its relatively little yield. The pump delivers only about 7-8 lt/min. At greater installation depth it becomes difficult to operate for women and small children.

Some of the well known weak points of the Vergnet pump were never corrected by the manufacturer. The footvalve is still prone to leakage. This would not drastically affect the performance of any piston pump. With the Vergnet system it means that the pump needs to be primed before it can be used after it had been idle for a while. Especially in areas where water is scarce the danger of polluting the borehole is imminent.

The cost of the pumps is relatively high. Private sales are between FCFA 400,000.- to 500,000.- depending on installation depth. It has to be noted that this price does include a VAT of 10%. The pump benefits from the probably most effective sales and marketing set-up in the country. The Vergnet dealer makes a committed and professional impression.

UPM: The UPM pump gives good service at the installation depth that are common in Burkina Faso. If installed at shallow depth the pump is comparatively heavy to operate. It can be operated by 4 persons this makes it specially useful at the deeper installations. Further, because of its unorthodox operation it can not be pumped with quick short strokes. This and the system of having a piston every 3 metres effect that the pump is not subject to peak stress caused by jerky operation. The yield is good.

Mechanics can easily intervene with the pump. The rope wears fast but if it breaks it can be repaired or replaced with minimum effort.

The current price of the pump in Burkina Faso could not obtained. 1992 price level at 50 m installation was in the region of FCFA 550,000.- (excl. VAT)

DUBA: The DUBA pump is not used very much in Burkina Faso. Because of its heavy weight it is not a pump that allows interventions by area mechanics with limited tools. It has a very high yield. It is quite reliable.

This pump should not be considered for use in Burkina Faso because of its non-VLOM characteristics.

Volanta: The Volanta pump was not visited during the evaluation. It is however a quite reliable pump with a good yield. It allows area mechanics to perform most of the repairs easily. The old unreliable piston rods with hook and eye connectors have now been replaced with threaded rods.

The pump and its spare parts are very expensive. In areas with aggressive water and deep installations it is a viable alternative to the UPM.

2.1.3.3 Spare Parts Distribution and Maintenance

Spare parts are subject to VAT throughout Burkina Faso. The spare parts sales network presents itself as follows:

India MKII — APICOMA
has a central outlet in Ouagadougou. Several small hardware store keep India MKII spare parts in stock and sell them on commission. In some cases this looks very unprofessional. The small hardware shops do not keep all parts in store and replenish their stock irregularly.

Vergnet — Faso Hydro
have a central stock in Ouagadougou and 4 sales outlets in Ouahigouya, Leo, Banfora and Bobo Dioulasso(?). Faso Hydro claims that they have all parts in stock in Ouagadougou at any time. They replenish their stock 5-6 times per year. Yearly total turnover is 1-2 millions FCFA. (This figure is unreliable as all the dealers were reluctant to disclose their sales figures)

ABI
Kardia — Faso Yaar
represents ABI and Preussag (about 3,200 pumps). Faso Yaar is a state owned trading company that has a Hydraulique Villageois department. They have sold for about $ 400,000.- to 500,000.- worth of pumps and spares in the last 10 years. Presently sales are going down as the government protection for state owned enterprises is reduced. Faso Yaar have clearly stated that if the pump sales are further diminishing they will close their rural water department. Theoretically all Faso Yaar sales outlets in the country stock pump parts. When I visited the shop in Ouahigouya I was told that they are not selling spares.

DIAFA — DIACFA
sells the parts for the DIAFA pump. Their system of spares supply is organized in the way that they have created containers that are stocked with spare parts and placed with a dealer in regional towns. 15 such containers are in the country. The dealer sells the parts on commission. DIACFA has a fixed pricelist that is the same in whole of Burkina Faso. The containers are visited every 3 months and replenished. This is the theory, reality looks different. The sales outlet in Kaya was empty and nobody ever looks after it.

UPM — EEPC
the system could not be assessed as the manager of EEPC was not in town. He is the only person in EEPC who knows how pumps and spare parts are sold.

Volanta — St. Famille
the factory was not visited. It is not represented in Ouagadougou. Spare parts can be purchased directly in the factory.

All Pumps — Safe the Children Fund
have a project in Dori province to maintain handpumps. This project was conceived because SCF found that many of the area mechanics were inefficient because of lack of proper training and lack of parts. They retrained

the already existing mechanics in the area to repair all type of pumps. SCF now keeps about 3 millions FCFA worth of parts in stock in Dori. Their annual turnover is about 1.5 millions FCFA. They issue a minimum stock of fast moving parts to their mechanic. Mechanics are not allowed to make any profit on parts sales.

Area Mechanics: The number of area mechanics in Burkina Faso is impressive. Since 1986 every project has trained mechanics. One mechanic covers in average about 15 to 20 pumps. This means that over the last 7 -8 years about 350-500 mechanics have been trained.

Interviews with area mechanics revealed the common problems that a these kind of mechanic face throughout Africa. Because they are from the same area and they are member of the community they are not always paid for their services. Sometimes they receive payment in kind. If they purchase the spare parts on behalf of the community they risk that the parts are not paid. Common practice seems to be that the communities purchase the parts themselves. Only if the parts are available the mechanic repairs the pump. This means often two visits by the mechanic to the pump.

Transport is a common problem. After some years the toolbox issued to the mechanics tends become empty. They have no means to purchase new tools.

Many mechanics are trained only on one type of pump as they were always attached to a particular project. Therefore they are limited in the interventions they can make. Because of this many times the number of pumps is small for the mechanic. The job of being an area mechanic is normally not economically viable on its own.

Technical Back-up system for major repairs: The DRE's keep mobile teams with a 4 wheel drive vehicle to support the area mechanics if they are not capable to perform major repairs. This is often the case if the cylinder was dropped down in the borehole. All these teams are presently financed by the government out of budgets for development projects. The government has not made any budget provisions to the DRE's to keep this service going after the projects are closed. As long as always donor financed projects are executed this service might be sustained.

2.1.4 Conclusions and Recommendations

Burkina Faso has theoretically established a community managed rural water supply system. All the facets that are considered necessary for a successful operation are in place:

- the private sector provides goods and services,
- the government restricts itself to the planning and supervision
- the communities take on responsibility for operation and maintenance.

On the level of the capital this all looks very well. But out in the villages it becomes obvious that the services do not actually reach the beneficiaries. Spare parts are not available, back up services depend on donor involvement and the percentage of pumps out of order is quite high. The situation is aggravated by the fact that so many different pumptypes were used and freely mixed. This prevented that a density of pumps was reached which would allow the private sector to intervene successfully (profitably).

Burkina Faso is an interesting example of the presently so fashionable policy of deregulation. It is one of the few countries in which this approach has been followed for years. Decentralization, less government direct intervention, private sector involvement and community management do not seem to yield better results than the traditional approach. This does not mean that the this policy needs to be condemned. It much more indicates that such a approach needs to be implemented with care.

The old approach of UNICEF projects has done little to establish sustainability. In recent years the UNICEF programme has started following the overall national policy. The cost effectiveness of the present UNICEF operation (drilling 40-50 boreholes per annum through the private sector and have this supervised by an expatriate hydrogeologist) is questionable. The choice of pumps (Vergnet and UPM) does not seem to be part of a long term strategy. It appears to be rather a coincidence. The UNICEF WES team is new and many of the decisions that were taken before the present personnel were employed.

The UNICEF project is presently not influential enough to achieve any significant changes in national policy. It is recommended that UNICEF in Burkina Faso tries to the upmost to cooperate with the government to support the efforts to at least regionally achieve some uniformity in the handpump park. The choice of pumps should be governed by this. From the technical or economical point of view the India MKII pump that was used in UNICEF projects for years still seems to be the best choice.

The number of broken down pumps would certainly merit to plan a rehabilitation programme. Such a programme could be executed in conjunction with the local manufacturer of India MKII pumps and could be utilized to establish a service network that reaches outside the boundaries of Ouagadougou.

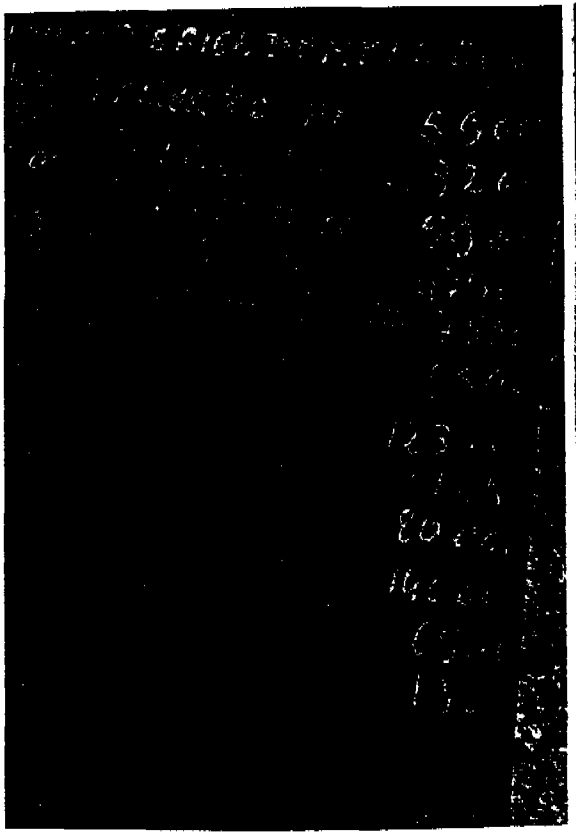

Figure 5 Pricelist for Spare Parts on a Blackboard

Figure 6 Diafa Pump

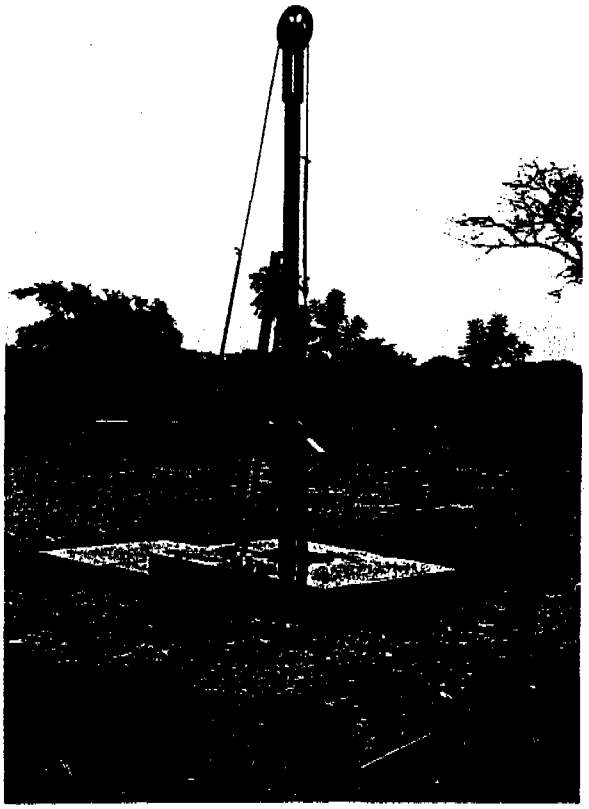

Figure 7 UPM Pump

Figure 8 Empty Shelf in the Vergnet Spare Parts Shop

2.2 MALI

2.2.1 Country Information

Mali has approximately 14,500 boreholes with handpumps. This represents a theoretical coverage of about 48% of the population with access to safe water. The number of handpumps out of service is estimated to be about 10-20%. This reduces the factual coverage to about 43%. Because of the hydrogeological conditions hand dug wells tend to dry out during the dry season. All year round water supply from hand dug wells is only possible in the south of the country. The emphasis of the construction work had been placed on boreholes with handpumps.

Since 1992 Mali is divided in 10 regions. Each of the region (which can include 2-3 cercles) had a regional base of DNHE established. All of these bases are functional except for one in the North where political unrest has prevented work. The regional bases are responsible for the planning of the construction work in their area. The regional bases of DNHE are not regularly funded by the government. They have to try to attract donor funded projects to finance their activities.

Mali has had standardized on handpump types for some years. The India MKII (India Mali) had been the pump that was generally recommended for all government executed projects: Recently this policy had been liberalized and other type of pumps were introduced. Following are the most commonly used types:

8-9,000	India MKII
2,000	Vergnet
800	Kardia
200	UPM
	Duba, Mono, Moyno, ABI MN and others

DNHE tries to realize some kind of standardization in Mali but has recently been subject to pressure from the donor community and the World Bank to allow free international bidding for pump supply for the projects.

Construction work is mostly done through donor supported projects. Many of the projects have come to a close by end of 1994 (DANIDA, Saudi, Italian, UNDP, Helvetas). A huge overcapacity of drilling equipment is presently in the country as each project has left their equipment with DNHE. DNHE has recently "inherited" 8 drill rigs from these projects and has no means to operate them. The project Aqua Viva, a NGO, has also stopped their activities and privatized their drilling unit.

Presently about 1,800 new boreholes are planned in the country. Their construction will take place in the next two years. After this no more big construction projects have been committed by donors. Recently competitive bidding for drilling was introduced. The work for siting, drilling, pump installation is contracted separately to the private sector. DNHE has now to participate in ICB tenders and to has to operate like a commercial enterprise. Several international drilling companies are operating in Mali. The Chinese have entered the market and cover the market with dumping prices. This is possible due to chinese government subsidies and very cheap labour.

Handpumps are normally supplied by the projects either through local representatives of the manufacturers from abroad or through the local manufacturer. One local company, EMAMA, produces handpumps in Mali. The technical training school Pere Michel in Bamako has entered a contract with the manufacturer of UPM in France to produce some parts of the UPM pump in the country.

All other major handpump suppliers are represented in the country. The representatives have their headquarters in Bamako.

National policy for operation and maintenance is that the beneficiaries communities have to take full responsibility for the day to day maintenance of the pumps. In some projects (UNICEF) the beneficiaries have to contribute towards the construction cost of the water point. In other projects the upfront payment is not needed, but the communities have to collect between 50,000 to 75,000 FCFA for future repairs. With the exception of the UNICEF projects the communities have to form a water committee (CPE) which consists normally of 7 persons (Chairman, secretary, treasurer, 2 hygiene workers, 2 pump caretakers). The hygiene workers are normally women, their responsibility is to keep the pump surroundings clean. The other members of the committee are normally men.

Artisan Reparateurs (field mechanics) are commonly trained either by the projects themselves or by the representatives of the handpumps. They are issued with a toolbox and sometimes receive a means of transportation. SETRA (representative of India Mali) provides the area mechanic with a mobilette. In other projects they are given a bicycle or a mobilette. It is not common that the mechanic also sells spare parts (with the exception of the Italian project). The mechanics are usually involved in the installation of the pumps for which they get paid. This is part of their training. A large number of mechanics have been trained over the years. By now new projects and rehabilitation projects tend to recruit mechanics that are already working in the project area and to retrain and re-equip them.

Spare part supply is left either to the private sector or is the responsibility of the projects. None of the pump suppliers were actually requested to establish regional sales outlets for spare parts. Even though Setra seems to have made a major effort to ensure the availability of spares through shops

2.2.2 UNICEF Programme

UNICEF financed programmes were executed by UNDP until 1988. The joint UNDP/UNICEF programme had been drilling about 1,200 boreholes in 10 years. Since 1988 UNICEF had continued its programme in 5 Regions under its own management. 270 boreholes were drilled since 1988 in Segou, Koulkoro, Gao, Mopti and Tembouktou. These boreholes were drilled by DNHE. In 1991 the UNICEF programme nearly came to a standstill because of differences with DNHE. Since about 1992 UNICEF has stopped drilling by themselves but has started to call for LCB for the construction of boreholes. Contracts are awarded for very small numbers of boreholes to favour local companies. Presently UNICEF has planned to drill about 260-300 new boreholes in the Mopti area. The pumps used in the UNICEF programme were India MKII (either from India or from local production, EMAMA). Presently UNICEF is using India MKII (up to 45 m) and UPM (over 45 m) pumps.

2.2.3 Field Trip Impressions

The following regions were visited:

Banamba
Segou
San
Mopti/Bankass

Due to the vast distances between the project areas and the dispersed population the number of pumps sites visited had to be restricted. Data about the pump installations were also not always available because the data is with the various project managements. A detailed database on national level is not readily available. It was possible to get a reasonable picture of the problems encountered in the field.

The pumps visited were 3 weeks to 12 years old. The type of pumps visited were India MKII, India Mali, Vergnet, UPM and Solar systems. Details about the visits can be seen in ANNEX IV.

2.2.3.1 **Operating Conditions** in the visited provinces:

General:

Planning and construction of water points appears to have been far more coordinated in the past than it is now. Since the decentralization the DNHE on national level seems to have lost control. Coordination of the activities in the regions has not yet been achieved. Various projects and NGO's operate in the same region without any coordination.

In the northern regions of Mali a system to subsidize maintenance water points with handpumps is needed. Here the villages have little economic activities outside the rainy season. To provide water to livestock is essential. If handpumps are installed at 50 -100 m depth pumping water for cows is not possible therefore the economic return from selling water for animals is missing. The pumps will break down frequently and repairs are expensive. To provide clean drinking water to the population it is necessary to support O&M.

Hydrogeology and water quality:

The pump installations are generally quite shallow 20-30 m in the south of the country and along the river Niger. In the North of the country they are deep to very deep. There cylinder setting varies between 30 to 100 m. The water is very aggressive in all parts of Mali. Therefore the use of corrosion resistant pumps (stainless steel, plastic rising main) is imperative.

Acceptance criteria for boreholes (in the UNICEF projects) is 1,000 lt/h. This means that normally the yield of the borehole is sufficient to allow the pump to be operated continuously.

Usage:

The economic activities in the villages concentrate on farming. They are governed by the rainfall pattern: rainy season from June to September and very dry and hot from October to

May. This allows only one crop during the rainy season. For the rest of the time livestock farming is dominant. During the rainy season it is however still common that alternative sources (dug outs or hand dug wells) are used. These sources dry out in March. This means that during the dry season the water from the handpump has to be shared between humans and animals. Communities that have a handpump tend to sell water to the nomadic herdsmen that roam towards the south of the country during this time. This using pattern means that pumps are operated for 18 hours per day during the dry season. Therefore the yield of a pumps is a very important factor for its acceptance in the community.

2.2.3.2 Pumps

Breakdown Rate

The information of how many pumps are actually operational is not very reliable. All quoted figures depend on guess work. It is assumed that about 80% of the pumps are in operational condition. In the Saudi financed project near Segou the rate of pumps out of order seems to be very high (more than 30% of the pumps out of order). This is mainly due to the fact that the project had been using Kardia and Pumpenboese India MKII pumps. After the close of the project, some two years ago, the supply of spare parts has completely stopped.

The observations about the pump performance per pump type are very similar as described in the Burkina Faso report. The India Mali pump seems to suffer more often from breakdowns that are related to bad workmanship during manufacture than the India MKII made in India. The cylinder of the India Mali seems to make some problems. A very fine threat is used to attach the endcaps. This has the effect that the endcaps become loose and fall into the borehole. The repair is quite costly as the footvalve is lost at the same time.

2.2.3.3 Spare Parts Distribution and Maintenance

Spare parts are subject to VAT throughout Mali. The spare parts sales network presents itself as follows:

India MKII

SETRA

SETRA has a financial participation of 14% in EMAMA, the local manufacturer of the India Mali pump. SETRA is now responsible for the marketing and sales of complete pumps and the sales of spare parts. 20 small hardware store keep India Mali spare parts in stock and sell them on commission. Pricelists are distributed. The set up looks quite professional. SETRA also fixes the prices per repair that can be charged by the area mechanics.

CM

The Italian projects sells the spare parts through the area mechanics. The project has initiated the formation of associations of area mechanics who jointly sell parts that are supplied to them by the project. End of 1993 the project is coming to an end. It is clear that the supply of spare parts to these associations will dry out in time. For the next 2-3 years the system might however remain operational as reasonably large stocks of spares are in the country.

Vergnet SOMIMAD
have a central stock in Bamako and sales outlets in the regions. The shop in Bamako looks well stocked and organized. Mr. Vincent, Director believes that community management is a failure. He would prefer to have a contract with the communities under which he would carry out preventive maintenance for a price of FCFA 40,000 per year. To make such a centralized maintenance viable he believes that he would need 1,000 pumps in one region. He would also not maintain pumps that are more than 5 years old as their requirement for spares would increase.

Kardia Sari Konadji,
represents Preussag (about 1,200 pumps). Sari Konadji is a hardware shop in Segou. They face the problem that, even though they have ordered spare parts from Germany, Preussag does not respond to their orders. This might be mainly due to the fact that sales of Kardia have seized and Preussag therefore have lost their interest. Presently many parts are missing and Kardia pumps can not be repaired.

UPM SMDD
SMDD in Bamako are presently the only outlet of spare parts in Mali. They plan to open sales outlets in the regions if the market develops. SMDD also plans to set up manufacture of some parts of the UPM pump in Mali together with the Pere Michel Technical Training School.

Area Mechanics: The number of area mechanics in Mali is relatively high. All projects have trained mechanics. The rate of pumps per mechanic varied form 20 to 50. The impression gained during the field trip was that the system with the area mechanics actually works in Mali. Interviews with area mechanics reveal that they have less problems than in other countries in Africa. Community seem to be willing to pay for their services. This might be due to the fact that handpumps are often a means of income to the villages as they sell water. For this reason they have a vital interest to keep the pumps operational. Prices are normally fixed by the pump suppliers.

In Segou I met an area mechanic who came to the regional base to borrow tripod and equipment for fishing out a cylinder that dropped into the borehole. He looked more like a farmer than like a professional. I asked whether he feels competent enough to do this without assistance. The answer was that he had done this several times before and that he would cope.

Area mechanics can perform incredible tasks (see box).

Technical Back-up system for major repairs: The DNHE keep equipment in their regional bases for major repairs. Area mechanics can borrow this equipment which enables them to perform the repairs. This is often the case if the cylinder was dropped down in the borehole. All the equipment is presently financed by the government out of budgets for development projects.

2.2.2.4 Conclusions and Recommendations

Mali has made considerable progress towards a community managed rural water supply system. The private sector capacity to provide goods and services has to a large extent been established. Communities take on responsibility for operation and maintenance. This can be attributed to the very particular situation in the country. But it is also the consequence of a policy of standardization in the past and the support that was given to the local manufacturer. For the main types of pumps spare parts are available, rudimentary back up services are provided by DNHE. The percentage of pumps out of order is reasonably low. Considering that Mali is one of the poorest country in the world this is quite an achievement.

Mali is now changing towards a policy of deregulation with less government intervention. This new approach brings a danger for the old structures. The existing setup depends on some government support as it has not yet had the time to firmly established. If the new approach is not implemented with care it might cause more harm than good. This has to be looked at especially in view of the fact that in the north of the country it seems not possible to provide water without subsidies.

In recent years the UNICEF programme has been instrumental in promoting community managed systems and a decentralized national policy. The effort to support small local contractors for LCB contracts should be continued. Even though they were not very successful as larger companies have more possibilities to undercut prices in market that is characterized by over capacities. The UNICEF WES team is highly motivated and can be influential to achieve significant changes to establish sustainability.

It is recommended that UNICEF in Mali keeps up the momentum to assist the government in its efforts to achieve a policy change without putting the success that had been made in jeopardy. The continued use of locally manufactured India MKII pumps for installations up to 45 m and the use of UPM for deeper installations makes good sense.

The number of pumps that are quite old make it essential to plan a rehabilitation programme. Such a programme could be executed in conjunction with the local manufacturer of India MKII pumps and could be utilized to strengthen the service network that has been established.

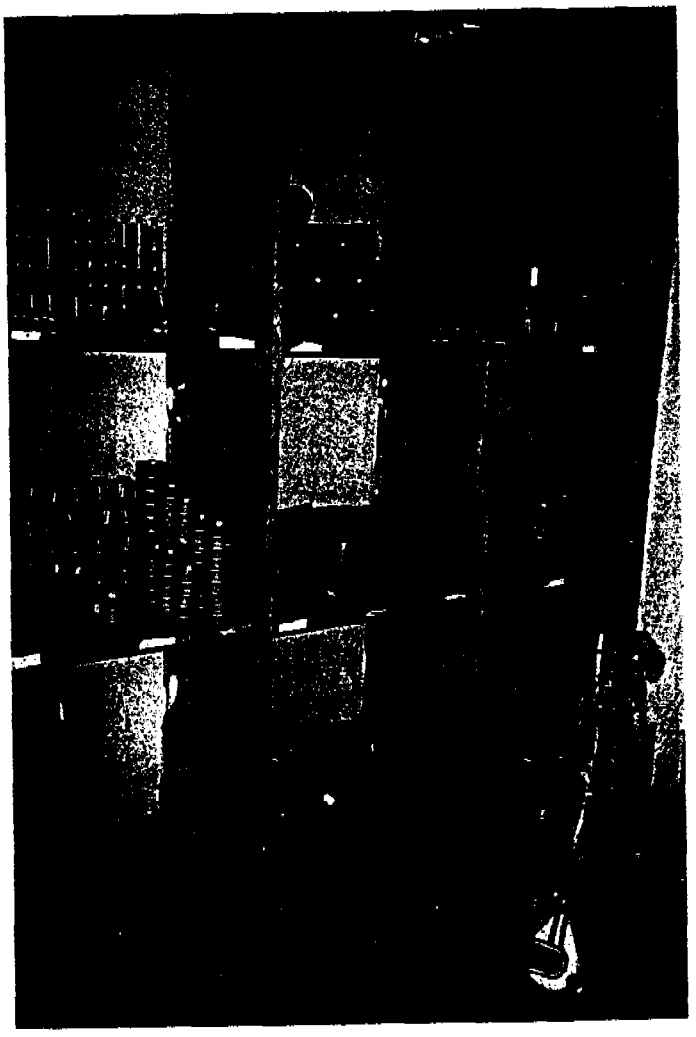

Figure 9 Well stocked Spare Parts Shop

Figure 10 Sign in front of a Spare Parts Shop

Figure 11 One pump for human and one pump for animal consumption

2.3 Nigeria

2.3.1 Country Information

The situation in Nigeria is quite different from the other visited countries. This stems from the fact that Nigeria used to be a rich country that could afford to pay for large part of their infrastructure. Because of the size and the decentralized structure, with independent states, it is difficult to obtain a unabridged picture of the situation in rural water supply. The lack of data is apparent. Presently it is estimated that 70% of the rural population does not have access to safe water and 75% do not have access to sanitation facilities. The 30% coverage of water represents about 25,000 to 30,000 boreholes with handpumps. The need for total coverage would be about 150,000 boreholes.

The political situation (with unrest and uncertainty in the transition to democracy and elected government) makes it difficult to predict how future programmes will be executed. The UNDP-World Bank has worked out a sector strategy for Nigeria. The strategy entails private sector involvement and community management of water points. It is however not clearly discernible whether and how this new strategy will be implemented.

Until now the handpumps that have been used in Nigeria were mostly India MKII. Imported through ADP's or through DFFRI's. A local company, Nigerian Foundries, has produced more then 2,000 pumps (a copy of the India MKII) and set up an after sales network in conjunction with UTC. Since 1991 the government has decided not to purchase pumps from this company any more. Therefore this activity has ceased.

The FMWAI has standardized on two types of pumps (India MKIII and Afridev). It is however not yet clear to what extent the decision to standardize will be enforced. Despite the huge market potential local production of pumps is still very much in the beginning. One company (M&W in Maiduguri) has seriously started to produce Afridev pumps.

2.3.2 UNICEF Programme

The UNICEF programme in the country needs to be looked at in the context of the past when Nigeria was basically executing the RUWATSAN projects under their own financing. UNICEF is assisting in 15 states the RUWATSAN Units by providing equipment. In general UNICEF purchases the drilling rigs and the handpumps and Nigeria pays for materials and operational costs. In the last few years this policy has become less effective as the RUWATSAN projects have received less and less government funding to cover the operational costs. With the rapid devaluation of the Naira this becomes even more pronounced.

Presently UNICEF tries to achieve a higher output per rig to reach the mid decade goals. The present results of 20 boreholes per rig per year are certainly not outstanding. It is however questionable whether a higher production rate can be achieved without changing the total approach. Under the present set-up UNICEF has no managerial function in the execution of the projects. The role of UNICEF is to assist setting up RUWATSAN Units.

In 1990 UNICEF and RUWATSAN declared a switch to community management. In actual fact the only visible change was that UNICEF started buying India MKIII instead of India MKII. In the villages however nothing really changed. No training or extension work was conducted.

The villages are still depending on the State or the LGA for maintenance of the pumps. UNICEF has not encouraged or facilitated the supply and sales of spare parts through private outlets. Spares are theoretically available free of cost from the LGA.

Under the given arrangement that Nigeria purchases all locally available materials and UNICEF the materials from abroad it made sense to investigate the use of locally produced PVC rising mains for India MKIII pumps. UNICEF encouraged Mutunci Pipes Ltd., Kaduna to produce 75 mm diameter PVC rising mains with threaded ends and polyethylene connectors. Field trials were made in an un-correlated manner. Pumps were installed with these pipes and never properly monitored. Many of the failures went unrecorded.

The company has invested quite some time and money in the development. A second generation of pipes was developed with polyethylene ends injection moulded directly onto the PVC pipes. By beginning of 1994 Mutunci will produce the third generation of PVC pipes. UNICEF has offered to assist in the development by paying for lab-tests. This will be done under the condition that the PVC pipes should eventually be a product in the public domain. Until now these efforts were little known outside Nigeria the development has been isolated from the rest of the world.

2.3.3 Field Trip Impressions

The short field trip allowed to visit only one state RUWATSAN project. Therefore the impression I got might not be representative for the whole country. I was however told that the visited Niger State RUWATSAN project is one of the better ones in Nigeria.

2.3.3.1 Operating Conditions

General

Development of water points falls in the responsibility of several governmental agencies. Various governmental projects and NGO's operate in the same region without any coordination.

The quality of the work done in the past is questionable. Many boreholes have not been drilled deep enough and therefore dry out during the dry season. Boreholes are not always properly developed. Acceptance criteria for boreholes are not adhered to. Some boreholes are lined only in the overburden (and even this is not always the case). Under the present system it is unlikely that the quality of boreholes drilled by the state will improve. If drilling is contracted to the private sector the capacity in the government to effectively supervise the works is not available. Cost of privately drilled boreholes are high Naira 250-500,000.- ($10-20,000.-)

Hydrogeology and water quality:

The pump installations are generally quite shallow 20-30 m in the Niger state. In the North of the country they are deep to very deep. The water is very aggressive in most parts of Nigeria. The use of corrosion resistant pumps (stainless steel, plastic rising main) is necessary. Nigeria does also have vast areas where the water table is very shallow and even the use of direct action pumps could be considered.

Usage:

In the visited Niger state the soil is fertile and rainfall is frequent. Rainwater harvesting is possible. The villages can grow cash crops and have many economic activities without the need for irrigation. Animals are not drinking the handpump water. Theoretically one water point is planned for every 250 people. The pumping lift is shallow to moderate. Therefore the pumps are not very heavily used. In other parts of Nigeria these usage conditions might be significantly different.

2.3.3.2 Pumps

Breakdown Rate

The information of how many pumps are actually operational is not reliable. It is assumed that about 50% of the pumps are in operational condition. This figure might be optimistic. The fact that the operating conditions are by no means severe and that the used India MKII and MKIII pumps are quite reliable and sturdy alleviates the situation. The pumps are working without maintenance for several years. It is however deplorable that their service life is not 10 years and more.

2.3.3.3 Spare Parts Distribution and Maintenance

Maintenance and spare part distribution is entirely the responsibility of the LGA's. UNICEF has provided vehicles and tools to some of the LGA's. In the Niger state only 2 out of 7 LGA have a vehicle. It could not be assessed whether the vehicle are actually used for their intended purpose. LGA have a limited stock of spares. If a pump breaks down the community reports this to the LGA. The LGA team is supposed to repair the pump free of charge. In reality this is not always the case. Some villages have been asked to pay for the repair. The response time for a LGA team to go and repair the pump can be very long.

For this reason villages tend to directly report the breakdowns to the state RUWATSAN unit. The team that normally installs pumps makes is in charge of repairing the reported pumps. Response from this team is also slow and not reliable.

No area mechanics or outlets of spares are available as alternatives to the government services. Under these circumstances it is fruitless to talk about community maintenance. UNICEF plans to introduce the training of some area mechanics. But on the level of the RUWATSAN projects it appears that nobody has given a thought to any changes.

2.3.4 Conclusions and Recommendations

Historically Nigeria used to be a rich country in Africa. In this context it is understandable that the UNICEF programme had a different outlook in Nigeria than in other African countries. In the meantime Nigeria is not a rich country any more but the attitude of the Nigerians has not yet changed and also the UNICEF programme has not yet changed. In terms of rural water supply (coverage and capacity building) Nigeria is by now several years behind the rest of Africa. Since the financial resources (within Nigeria and UNICEF) are diminishing constantly an approach with ambitious goals to cover the country in a few years is becoming increasingly unrealistic and wasteful.

UNICEF is prepared to pay for (part) of the costs of these test it is recommended to enter an agreement with Mutunci that the product will eventually be in the public domain.

SOVEMA has developed a PVC rising main system in which stainless steel ends are attached to the PVC pipes. This system too appears to have a considerable potential for the India MKIII pump. It is however not yet field tested. I understand that UNICEF Nigeria has purchased large numbers of these pipes (11,000 units). Since these pipes have not yet been used successfully elsewhere in large scale it is recommended to carefully employ this new technology. Similar as described for the Mutunci pipes it would make sense to use these Sovema pipes firstly on about 50 pumps only and to monitor their performance closely. Once the results from these first 50 pumps are known a large scale utilization could be started.

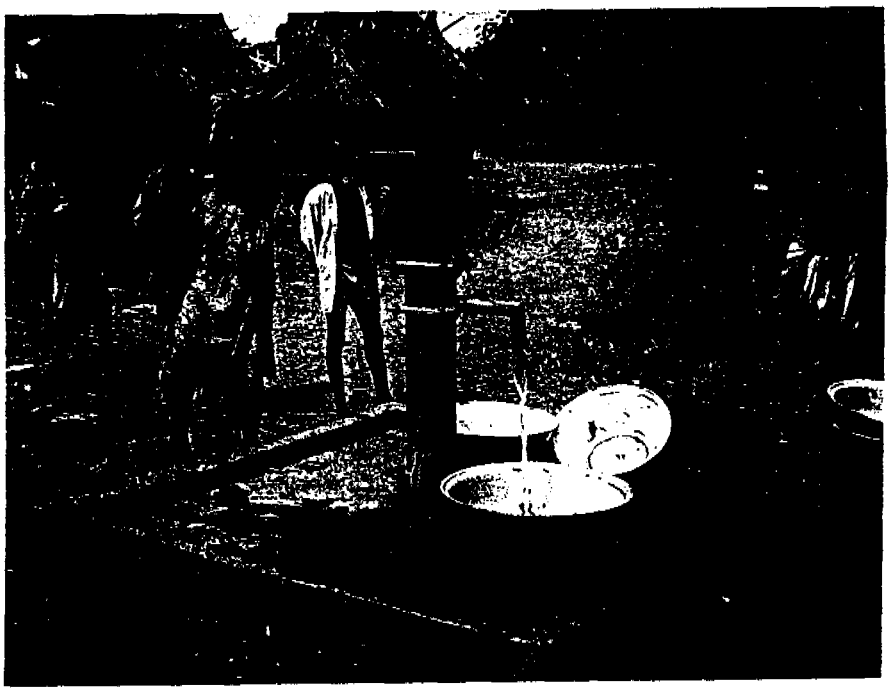

Figure 12 India MKII in Nigeria

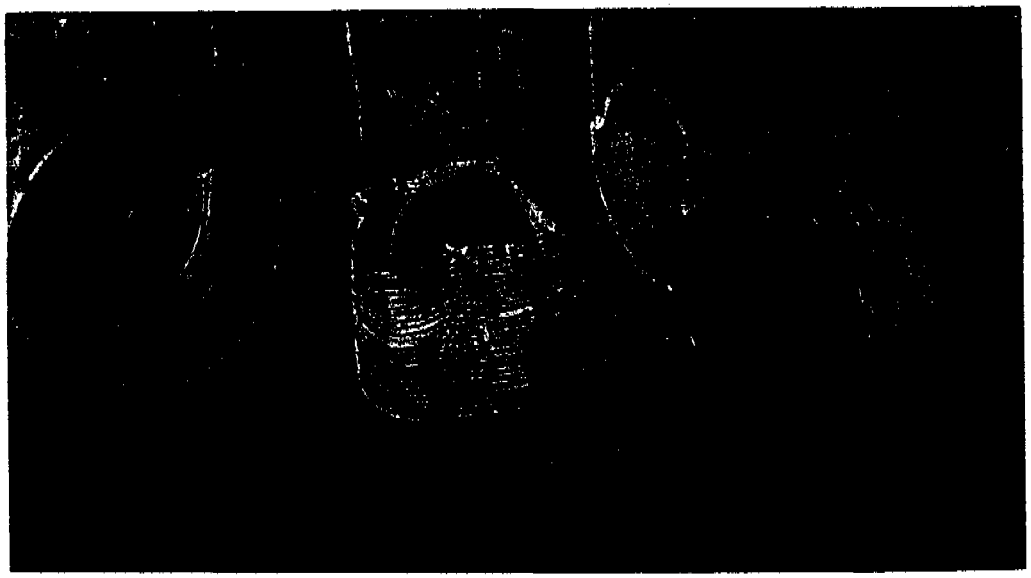

Figure 13 PVC rising main from Mutunci with broken sockets

Figure 14 India MKIII rising mains and rods with broken connectors. Note the bent rods.

Nigeria does not have any working models of water supply projects. Working with the government is complicated because of the present political unrest. Further the governmental structure with 30 independent states makes it difficult to achieve a common approach. Working with the private sector is equally difficult as private business in Nigeria has developed a low sense of business ethic. This requires constant close supervision of all contracted work.

The UNICEF assistance policy in which UNICEF pays for all imported material and Nigeria pays for local material and operational costs will become increasingly less efficient. If 50% of all the boreholes are not operational after 4 years and the execution of the projects is of such low standard that not even enough data is available to allow a rehabilitation programme the waste is not acceptable.

It is recommended that UNICEF reconsiders it assistance to the RUWATSAN projects. New models of cooperation should be developed. As a general rule it might be necessary to reduce the targets from the presently ambitious goals of producing large numbers of water points to more realistic interventions. In the long run it might be more effective to provide water to a smaller number of beneficiaries but at the same time work effectively towards building the capacity to sustain these infrastructures.

A reduced UNICEF involvement could be one (or few) pilot project(s) in which ways and means of cooperation between the federal government, the state government, the private sector and the beneficiaries are tried out. Such demonstration projects would need to be designed very carefully. They should include components of collecting data of existing water points in the area of operation and their rehabilitation. New water points should be planned with the beneficiaries participating in the planning process. Private sector involvement should be carefully considered. The role of the state governments and all the other governmental agencies would need to be defined. The objectives of such demonstration projects should primarily be to establish workable models of cooperation between the government, the beneficiaries and the donors. Achievement of coverage would only have secondary importance. Obviously such projects would need to be followed closely by the UNICEF personnel.

Development of rising mains for India MKIII

Until now the efforts by Mutunci to develop a PVC rising main have not yet reached any big success. It is encouraging to see that the private sector is taking an initiative. However the way the field trials were conducted should not be repeated. To get meaningful results from the field it is just not good enough to fit several hundred pumps with PVC rising mains and leave them without establishing a proper monitoring system. The monitoring results from field tests should give clear indications why a product failed and hints of how improvements can be achieved. One other point should be considered when test projects are executed, the villagers are actually carrying the risk if they are left alone with a broken down experimental pump.

Mutunci is in progress of finalizing their third generation of PVC rising mains. It is too early to comment on the prospects of this development. Since in areas with aggressive water the India MKIII needs SS rods and rising mains which is extremely expensive any effort to find workable solutions which are cheaper should be supported. In the case of the Mutunci pipes laboratory tests in CRL are planned. These tests should first be conducted. If they indicate that the product might have a potential it is recommended to install about 30 - 50 pumps with these rising mains. The field test should be closely monitored to get valuable results. Since

2.4 Benin

2.4.1 Country Information

Benin has approximately 4,900 boreholes with handpumps. This represents a coverage of about 52% of the rural population with access to safe water. Because of the hydrogeological conditions the construction of boreholes with handpumps is difficult in the south. In the North the conditions are favourable. This might be the reason that the coverage in the North is higher.

Benin is divided in 6 Departements. It is planned that each Departement will have a decentralized regional direction established. Presently the national DH is responsible for the planning, supervision and in cases also for the execution of the construction work.

Benin has the following most commonly used handpump types:

1,440	ABI ASM
900	India MKII
425	ABI-MN
160	Vergnet
280	UPM
150	Nissaku
200	DIAFA
35	Mono
30	Aquadev/Afridev

All the ABI ASM pumps never gave any satisfactory service. Most of them are broken down. A rehabilitation programme is presently under way to replace all these pumps. DH tries to realize some kind of standardization in Benin by recommending 3 types of pumps for use: Vergnet, UPM and India MKIII.

Benin has adopted a national policy that was formulated by the UNDP/World Bank Water and Sanitation Program. This policy entails in general the following aspects:

- Role of the government restricted to facilitating, regulating, planning, supervising and monitoring,
- Decentralization of government,
- Delivery of goods and services through the private sector,
- Community management of water points,
- Demand driven approach with communities paying a high percentage for the construction of the water point and full running cost of O&M.

A large World Bank project will commence July 1994 to introduce this policy in the country.

Already by now construction work is mostly done through local competitive bidding. This is the common model for French financed projects. The work for siting, drilling, pump installation is contracted separately to the private sector. UNICEF is to only organization that does not follow this trend. Handpumps are most of the times supplied through local representatives of the manufacturers from abroad.

National policy for operation and maintenance is that the beneficiaries communities have to

take full responsibility for the maintenance of the pump. The communities have to contribute towards the construction cost of the water point. They need to pay an upfront payment of 60,000 FCFA and on top of this they need but need to have collected 60,000 FCFA for future repairs. This amount will be placed in a local bank account. Each community has to form a water committee (CPE) which consists normally of 7 persons (Chairman, secretary, treasurer, 2 hygiene workers, 2 pump caretakers).

Artisan Reparateurs (field mechanics) are commonly trained either by the representatives of the handpumps or by the project themselves. They are issued with a toolbox but normally do not receive any means of transportation. It is not common that the mechanic also sells spare parts. The mechanics are usually trained by employing them to help during the installation of the pumps. They get paid for this training. Once they are installed they work completely independently.

Spare part supply is left entirely to the private sector. All pump suppliers are required to establish regional sales outlets for spare parts.

2.4.2 UNICEF Programme

UNICEF has been drilling about 900 boreholes over the last 10 years, mostly with financial support by USAID. UNICEF policy had not followed the national policy. UNICEF has been operating its own drilling team and purchased the handpumps through Copenhagen. The pumps used in the UNICEF programme were India MKII (either from India, Mali or from Germany). The establishment of an effective after sales service for the pumps was not a prime priority of the UNICEF activities, even though UNICEF trained area mechanics. However an initiative to sell spare parts by a private company was supported by the project. So that by now three private sales points for spare parts are operational in the UNICEF intervention area.

Bilateral funding of the project has come to an end. For 1994 UNICEF faces serious financial problems and the continuation of the operation is not ensured.

UNICEF in connection with the Guinea Worm Eradication Campaign has embarked on a programme of community sensibilisation. Planting of vegetable gardens and tree nurseries next to the water points is actively encouraged. Also the construction of VIP latrines in schools was started.. The results from this work are very impressive. Gardens and small tree nurseries are neatly kept by the communities. The project keeps a close contact with the communities. As a result of these efforts the pumps are also well maintained. According to UNICEF personnel 90% of the pumps are in operation. These achievement have never been well documented, (probably because the project personnel spent more time in the field interacting with the communities than writing reports).

2.4.3 Field Trip Impressions

Due to the restriction in time it was not possible visit a large number of pumps sites. Only the UNICEF project area was visited. However I had visited Benin in 1991 and have a good impression about the situation in other project areas. Because of family reasons (the UNICEF project officers mother died during the mission and he had to leave) it was not possible to get all the data about the pump installations.

The visit to the UNICEF project was one of the positive highlights of this mission. The team in Benin is highly motivated and has its priorities set on work in the field. Extension work for gardens, tree nurseries and guinea worms prevention was mostly done by the master driller and the technical staff (this might explain why the gardens actually exist in the villages and not only on paper). The project concentrated not only on boreholes and handpumps. Solar pumps and rainwater catchment tanks were installed if they were more feasible. Latrines were built in schools. The latrines give the impression that are actually used. The pumps are maintained because the project team has a continued contact with the communities.

The main impression was that the UNICEF project had concentrated so much on the work in the field that it never really found time to reflect on what they were actually doing. The question of sustainability was not addressed. The time after the project ended was not considered. Because of this their work is now subject to all kind of criticism.

2.4.3.1 **Operating Conditions** in the visited provinces:

General:

Development of water points is coordinated by DH based on a national database. Previously the objectives used to be to provide 20 lt/day and capita by drilling one borehole for every 500 inhabitants. Many villages have several boreholes with handpumps installed. Presently the trend is to use the best suited technology instead of implementing only one technology.

Hydrogeology and water quality:

The country can roughly be divided in two hydrogeological zones. The south with sedimentary formation. Here the pump installations are generally deep to very deep. The cylinder setting varies between 30 to 70 m. The north with the aquifers in the bedrock. Here the pump installations are shallow (cylinder setting between 15 -25 m). The water is mainly aggressive with the exception of the Zou region, the project area of UNICEF. Therefore the use of corrosion resistant pumps (stainless steel, plastic rising main) is not always imperative for UNICEF.

Acceptance criteria for boreholes (in the UNICEF projects) is 700 lt/h. This means that normally the yield of the borehole is sufficient to allow the pump to be operated continuously.

Usage:

In the south rainfall is quite dispersed during the year. Farming and rainwater harvesting is possible during most the time. Alternative water sources are in most villages relatively easy accessible. Animals are not using handpump water.

In the north the economic activities are governed by the rainfall pattern: rainy season June to September and very dry and hot from October to May. This allows only one crop during the rainy season for the rest of the time livestock farming is dominant. This means that during the dry season the water from the handpump might also be consumed by animals. During the rainy season it is however still common that alternative sources are used. This using pattern means that pumps are moderately used. In the south with less quantity but from greater depth and in the north with higher quantity but shallow lift.

2.4.3.2 Pumps

The Breakdown Rate is quite well known as the DH keeps a good database of all water points in the country. This database is brought to the actual stand in regular intervals. The database has been the basis for the decision to replace all ABI ASM pumps in a nationwide rehabilitation programme.

The DH published the results from a survey done in Dec. 1992. The official figures are as follows:

Table 2:

Pumptype	Number of Pumps	% broken down	Age of Pumps
ABI ASM	1,440	57%	3-7 years
India MKII	866	17%	1-12 years
ABI-MN	421	23%	4-8 years
UPM	282	2%	0-1.5 years
Vergnet	160	1%	0-1 year
Nissaku	150	30%	1-3 years
Diafa	200	33%	1-3 years

It should be noted that UPM and Vergnet pumps are all very new. Therefore the number of pumps not in service is very low.

India MKII: According to UNICEF about 90% of the India MKII are operational in their project area. The pump performs well under the light to moderate user conditions. It is robust, repairs are normally minor. Piston seals, bearings and chains have to be replaced regularly as they are wearing parts. If this is done the pump can provide good service for many years. It is easy to operate and has a relatively high yield. Since the setting up of spare parts sales points the after sales service can be arranged.

In the south of UNICEF project area the installation depth is often more than 40 m. The pump is hard to operate and it is difficult for the area mechanics to intervene when they have to lift the cylinder and the rising main.

It is relatively cheap with cost of FCFA 150,000.- at 0 m from Jupiter, imported pumps from India would be even cheaper.

ABI MN/DIAFA: The ABI MN and the DIAFA have similar characteristics like the India MKII. the replacement of the plastic bearing can easily done by the area mechanic. The quality of the DIAFA pump leaves room for improvement. The DIAFA pumps uses PVC rising mains which account for most of the early breakdowns. Further the pump has had considerable problems with cracking of cylinder sleeves.

ABI has stopped the production of the MN and the DIAFA is not represented in the country.

Vergnet: The Vergnet pump works satisfactory under the prevailing operation conditions. It is easy to maintain by an area mechanic. All aspects about the pump mentioned earlier (low yield, problems with footvalves) apply also in Benin.

The cost of the pumps is relatively high FCFA 350,000.- for 30 m installation depth.

UPM: The UPM pump gives good service at the deeper installations. It can be operated by 4 persons this makes it specially useful at the deeper installations. The yield is good. All aspects about the pump mentioned earlier apply also in Benin.

The pump is very expensive. The current price of the pump in Benin is FCFA 800,000.- to 1,000,000.- at 60 - 80 m installation depth.

NISSAKU and ABI ASM: Both these types have had so many problems in Benin that they are not considered any more for use. Even the Japanese project has now switched over from the NISSAKU to the standardized pumps.

2.4.3.3 Spare Parts Distribution and Maintenance

The spare parts sales network presents itself as follows:

India MKII — Jupiter
has contracted three hardware stores in Bohicon, Dassa and Save. These shops keep India MKII spare parts in stock and sell them on commission. The prices of spares are annually agreed with DH and officially published.

Jupiter is the representative of Richardson and Cruddas, Madras.

Vergnet — Vergnet Distribution Benin
have a central stock in Cotonou and 5 sales outlets in Oueme and Mono region. These outlets sell on commission (20%). The stock of spares is about FCFA 6,000,000.- Sales are little as most pumps are new.

Sales of spares are not financially feasible on their own.

UPM — SATT
is the representative of UPM pumps. Spare parts are sold directly from Cotonou. A sales network has not (yet) been established.

ABI — ABI Benin
have ceased to sell parts.

Area Mechanics: Since years every project has trained mechanics. The rate of pumps per mechanic is in average about 15 to 20. Area mechanics have the same problems as in the other visited countries. They do not sell parts. The community purchases the parts by themselves. This means often two visits to the pump. In Benin bushtaxis are not always readily available which makes transport difficult. Therefore the VLOM properties of a

handpump become less important as transport and time spent for travel by far exceeds the actual repair time.

Technical Back-up system for major repairs: The UNICEF project keeps a mobile team with a 4 wheel drive vehicle to support the area mechanics if they are not capable to perform the repair. Other projects do the same. The DH has not made any budget provisions to keep this service going after the projects are closed. As long as always donor financed projects are executed this service might be sustained.

2.4.4 Conclusions and Recommendations

Benin is one of the few countries in Africa in which donor support is not reduced. The situation is actually such that donors find it necessary to intervene in the same regions where already other donors are working. In Zou, the UNICEF project area, new projects have started or are in process of being launched (JICA and World Bank). Such a situation obviously requires fine-tuning with the other partners.

The World Bank project has the objective to create the capacity in the country to implement the national strategy that had been formulated by the RWSG in Abidjan. Therefore this project has little room to accommodate any achievements of the past if they do not fit in well with the new philosophy. This affects the UNICEF project. It is unfortunate that the funding for the continuation of the UNICEF project is not ensured. The UNICEF project represents the traditional project approach executed by the government and managed by expatriate project personnel. The WB project tries to implement a bottom-up approach in large scale. It is quite conceivable that the WB project will face teething problems when this new approach is being put into practice. Scaling up an operations does not necessarily mean it will also speed up. The success WB projects is measured the criteria of disbursement rate. Therefore towards the end of the project cycle the WB project might all of a sudden have to produce hardware. It would be very useful to have a well managed UNICEF project in operation during the initial phase in which the WB project is running its motivation campaign. I personally believe that a well executed traditional project and a community managed project being executed in parallel and being well coordinated would bring about a synergy effect that could benefit both.

It is recommended that UNICEF keeps its operation in Benin going at a reduced level for at least two more years. The equipment is already in place. Cost of the project would mainly be the labour cost and the cost for consumables. During this two years a maximum on coordination with the other projects should be aspired. In the discussion with DH, WB, RWSG and JICA the experience of the past 10 years could be made known. Eventually all the projects might benefit from this exchange of views. Such a continuation of the project would allow to safeguard the impressive results that the UNICEF project has realized. It would however require an open mind and the will to change also from UNICEF side.

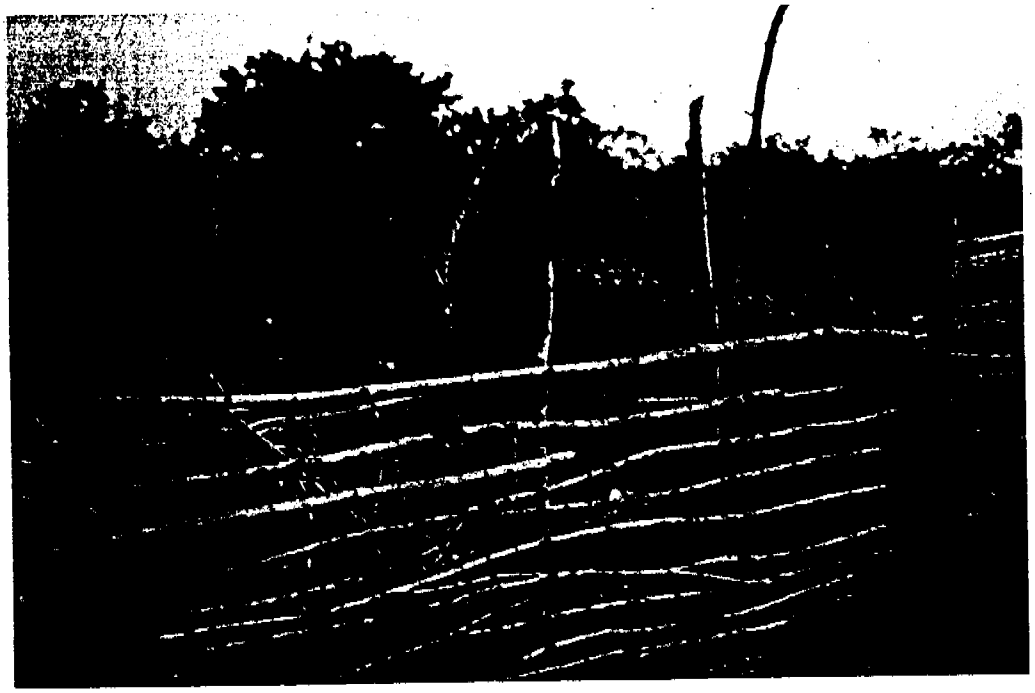

Figure 15 Vegetable garden next to Handpump in Benin

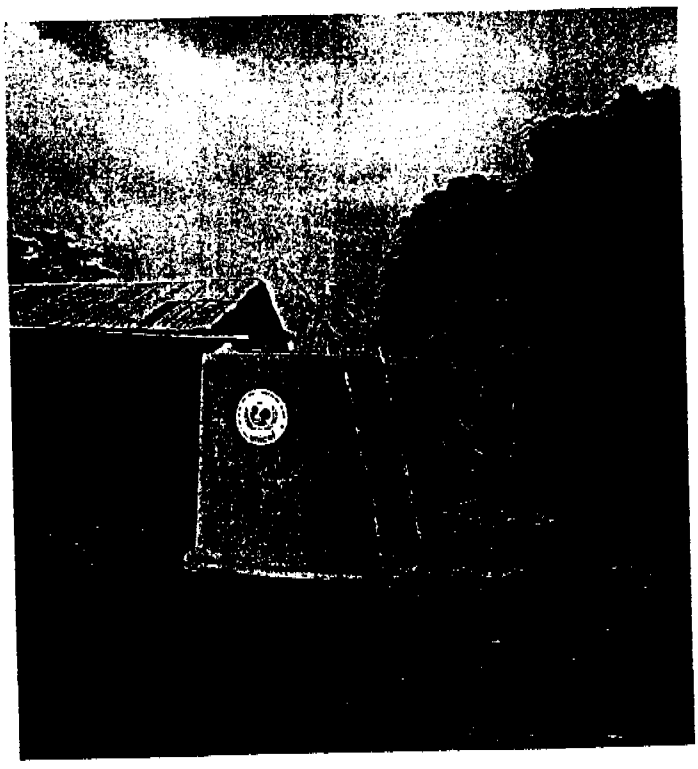

Figure 16 Rain water catchment made by UNICEF project

3. Pump performance summary

The detailed pump performance assessment is given in Annex V. The pumps were assessed according to the criteria as specified in the TOR.

3.1 Grading of the Criteria

Depending on the operating conditions the individual criteria need to be rated according to their importance. For example: in areas with aggressive water corrosion resistance is a prime criteria or in areas where the beneficiaries use their handpumps for drinking livestock the yield is of very high importance. It is not possible to categorize all the differing conditions. To achieve a limited number of categories that represent approximately the service conditions in the visited countries the following 4 categories were selected:

a) Shallow installations up to 45 m in non-aggressive water
b) Shallow installations up to 45 m in aggressive water
c) Deep installations over 45 m in non-aggressive water
d) Deep installations over 45 m in aggressive water

The following table shows the grading that were given in the above categories:

Table 3:

CRITERIA	NON AGGRESSIVE WATER		AGGRESSIVE WATER	
	<45 m	>45 m	<45 m	>45 m
INTERNATIONAL SPECIFICATION	2	2	2	2
EASE OF INSTALLATION	1	2	1	2
EASE OF REPAIR	3	4	3	4
RELIABILITY	5	5	5	5
CORROSION RESISTANCE	1	1	5	5
ABRASION RESISTANCE	2	3	2	3
USER PREFERENCE	4	3	4	3
DISCHARGE	4	3	4	3
COST OF PUMP AND SPARES	5	5	5	5
SUITABILITY for LOCAL MANUFACT.	2	1	2	1
AFTER SALES SERVICE	4	5	4	5

3.2 Assessment of the Pumps

Annex V gives the detailed analysis of the performance of the most commonly used handpumps in the four visited countries. All the below assessed pumps can be categorized as viable pumps. They performed at least satisfactory. Pumps which did not perform in the

visited countries (like the ABI ASM, Pulsa, etc.) were excluded from the assessment. Pumps that are not used in substantial number (VOLANTA) or not produced any more (ABI-MN) were also excluded. The below table summarizes the findings:

Table 4:

CRITERIA\PUMP	India MKII GI		India MKII SS		India MKIII GI	India MKIII SS	Kardia	UPM		Vergnet	
	<45 m	>45 m	<45 m	>45 m	<45 m	<45 m	<45 m	<45 m	>45 m	<45 m	>45 m
INTERNATIONAL SPECIFICATION	+++	+++	+++	+++	+++	+++	-	-	-	-	-
EASE OF INSTALLATION	+	+	+	+	+	+	+	-	-	+++	+++
EASE OF REPAIR	+	-	+	-	++	++	+	+++	+++	++	++
RELIABILITY	+++	+	+++	+	+++	+++	++	++	++	++	+
CORROSION RESISTANCE	-	-	+++	+++	-	+++	+++	+++	+++	+++	+++
ABRASION RESISTANCE	++	+	++	+	++	++	+	++	++	++	+
USER PREFERENCE	++	-	+++	-	++	+++	+++	+	++	+	-
DISCHARGE	+++	-	+++	-	+++	+++	+++	++	++	+	-
COST OF PUMP AND SPARES	+++	+++	+	-	+++	-	+	+	-	+	-
SUITABILITY FOR LOCAL MANUFACT.	++	++	++	++	++	++	-	++	++	-	-
AFTER SALES SERVICE	+	+	+	+	+	+	-	++	++	+++	+++

Note: +++ = 3 denotes that the pump was rated very good
++ = 2 denotes that the pump was rated good
+ = 1 denotes that the pump was rated adequate
- = 0 denotes that the pump was rated poor

3.3 Suitability of Handpumps

To assess the best suited pumps for the 4 categories of service conditions the above ratings in Table 4 were multiplied with the grading of the criteria in Table 3.

Pumps which would not be suitable for any of the categories were directly excluded (e.g. India MKIII was not assessed for installations deeper than 45 m or India MKII with GI pipes and rods were not assessed for aggressive water).

The following points and totals were calculated:

<45 m, non-aggressive Water

Table 5:

CRITERIA\PUMP	Grading	India MKII GI		India MKIII GI		Kardia		UPM		Vergnet	
INTERNATIONAL SPECIFICATION	2	3	6	3	6	0	0	0	0	0	0
EASE OF INSTALLATION	1	1	1	1	1	1	1	0	0	3	3
EASE OF REPAIR	3	1	3	2	6	1	3	3	9	2	6
RELIABILITY	5	3	15	3	15	2	10	2	10	2	10
CORROSION RESISTANCE	1	0	0	0	0	3	3	3	3	3	3
ABRASION RESISTANCE	2	2	4	2	4	1	2	2	4	2	4
USER PREFERENCE	4	2	8	2	8	3	12	1	4	1	4
DISCHARGE	4	3	12	3	12	3	12	2	8	1	4
COST OF PUMP AND SPARES	5	3	15	3	15	1	5	1	5	1	5
SUITABILITY FOR LOCAL MANUFACT.	2	2	4	2	4	0	0	2	4	0	0
AFTER SALES SERVICE	4	1	4	1	4	0	0	2	8	3	12
TOTAL		72		75		48		55		51	

The India MKII and MKIII pump appear to be the best suited pumps for use in areas with shallow to medium water tables and non-aggressive water because of their low cost, high yield and reliability. Both pumps can be maintained under community management. Area mechanics can perform nearly all the repairs if spare parts are available. The reliability of the India MKII and MKIII pumps makes them a very reasonable choice for these conditions. The MKIII has a slight edge over the MKII as it will allow easier maintenance.

UPM, Kardia and Vergnet are much more expensive and do not offer any significant advantages. The UPM is heavy to operate. The Vergnet has a considerably smaller yield than the India pumps. Against Kardia counts the practically non-existent after sales service.

<45 m, aggressive Water

Table 6:

CRITERIA\PUMP	Grading	India MKII SS		India MKIII SS		Kardia		UPM		Vergnet	
INTERNATIONAL SPECIFICATION	2	3	6	3	6	0	0	0	0	0	0
EASE OF INSTALLATION	1	1	1	1	1	1	1	0	0	3	3
EASE OF REPAIR	3	1	3	2	6	1	3	3	9	2	6
RELIABILITY	5	3	15	3	15	2	10	2	10	2	10
CORROSION RESISTANCE	5	3	15	3	15	3	15	3	15	3	15
ABRASION RESISTANCE	2	2	4	2	4	1	2	2	4	2	4
USER PREFERENCE	4	3	12	3	12	3	12	1	4	1	4
DISCHARGE	4	3	12	3	12	3	12	2	8	1	4
COST OF PUMP AND SPARES	5	1	5	0	0	1	5	1	5	1	5
SUITABILITY FOR LOCAL MANUFACT.	2	2	4	2	4	0	0	2	4	0	0
AFTER SALES SERVICE	4	1	4	1	4	0	0	2	8	3	12
TOTAL		81		79		60		67		63	

The India MKII and India MKIII have achieved the highest points because of their high yield, reliability. Both pumps can be maintained under community management. Area mechanics can perform or assist in repairs if spare parts are available. The reliability of the India MKII and MKIII pumps makes them a very reasonable choice for these conditions. Because the SS rising main is lighter than the GI pipes the MKII can relatively easily be maintained. The cost saving of the smaller diameter pipes gives the MKII an advantage over the MKIII. The very expensive 2½" SS pipes bring the India MKIII on the same cost level as the Vergnet or UPM. If cheaper (plastic) rising main are developed the choice would be the India MKIII.

UPM, Vergnet and Kardia are not loosing so much ground on price reasons. If any of these pumps are prevalent in one area this should influence the choice on ground of uniformity of the pump park.

> 45 m, non-aggressive Water

Table 7:

CRITERIA\PUMP	Grading	India MKII GI		UPM		Vergnet	
INTERNATIONAL SPECIFICATION	2	3	6	0	0	0	0
EASE OF INSTALLATION	2	1	2	0	0	3	6
EASE OF REPAIR	4	0	0	3	12	2	8
RELIABILITY	5	1	5	2	10	1	5
CORROSION RESISTANCE	1	0	0	3	3	3	3
ABRASION RESISTANCE	3	1	3	2	6	1	3
USER PREFERENCE	3	0	0	2	6	0	0
DISCHARGE	3	0	0	2	6	0	0
COST OF PUMP AND SPARES	5	3	15	0	0	0	0
SUITABILITY FOR LOCAL MANUFACTURE	1	2	2	2	2	0	0
AFTER SALES SERVICE	5	1	5	2	10	3	15
TOTAL		**38**		**55**		**48**	

Deep installations of more than 45 m are anyhow critical as the effort for pumping water becomes very high. Children are not able to operate the pumps any more and adults find it difficult. Community management is questionable as all pumps have frequent breakdowns and are difficult to maintain. Area mechanics find it difficult to make repairs as they lack appropriate tools. Cost of maintenance is quite elevated.

Therefore under these conditions alternative options to lift water should always be considered. The only handpump type that is designed to work under these conditions is the UPM pump. Because of the possibility to have up to 5 people pumping at the time it can be utilized under these conditions. It is also the pump that allows interventions by the area mechanics.

>45 m, Aggressive Water

Table 8:

CRITERIA\PUMP	Grading	India MKII SS		UPM		Vergnet	
INTERNATIONAL SPECIFICATION	2	3	6	0	0	0	0
EASE OF INSTALLATION	2	1	2	0	0	3	6
EASE OF REPAIR	4	0	0	3	12	2	8
RELIABILITY	5	1	5	2	10	1	5
CORROSION RESISTANCE	5	3	15	3	15	3	15
ABRASION RESISTANCE	3	1	3	2	6	1	3
USER PREFERENCE	3	0	0	2	6	0	0
DISCHARGE	3	0	0	2	6	0	0
COST OF PUMP AND SPARES	5	0	0	0	0	0	0
SUITABILITY FOR LOCAL MANUFACTURE	1	2	2	2	2	0	0
AFTER SALES SERVICE	5	1	5	2	10	3	15
TOTAL		**38**		**67**		**52**	

The result for areas with aggressive water vary only very little from non-aggressive water. The total cost of borehole and handpump are anyhow very high. So that the additional cost for SS below ground components does not greatly affect the overall result. The UPM pump is also under these conditions the best available choice.

4. General Conclusions and Recommendations

Handpumps should not be mystified. Even though the choice of the handpump type is an important factor to the success of a water supply project. **A good handpump can not solve a badly designed or executed project.** Of all aspects the availability of spares and after sales services are the most important ones. It is therefore better to settle for a pumptype which is known to the area mechanics and which does have a support structure in place, i.e. projects should bear in mind what had been developed by others and adjust their policy accordingly in order to not putting in jeopardy what had been achieved.

In the visited countries in West Africa two outstanding features came up quite often:

a) highly corrosive water
b) very deep installations

Aggressive Water

Several pumps are corrosion resistant, like the Vergnet, Kardia, Volanta, UPM and the India MKII SS. In Nigeria and other countries tests and R&D are ongoing to develop a reasonably priced India MKIII that is corrosion resistant. It should be noted that the India MKII with SS rods and rising mains has relatively lightweight under ground components and can therefore be handled quite easily by an area mechanic. Because of the price difference between an India MKII and MKIII it makes presently economic sense to choose the first one if SS pipes have to be used. The development of India MKIII with alternative rising mains should however be intensified.

In Mali we visited a UPM handpump that was installed at 78 m. The villagers had to contribute 40,000.- FCFA towards the installation cost to get the borehole and the pump. Initially the village refused to pay this amount of money with the argument that they were poor and could not afford it.

After long discussions and lots of persuasion they eventually paid. Now the pump is installed and working. But it is very heavy to operate. When we visited the village we were approached by the leader that they would like to have a solar pump instead of the handpump. We explained that the village contribution to get a solar pump is 1,100,000.- FCFA. They clearly stated that they would be able and willing to pay this amount.

Deep Installations

It is a fact that pumping water from depth of more than 40-50 m is heavy work. A person with a reasonable effort of 100 Watt (this represents about the effort of a jogging person) can pump about 5-6 lt/min with a handpump when the water table is 50 m. This means that the time to fill a bucket is about 3-4 minutes. So when we compare this effort with the distance covered by a jogger we find, to fill a bucket of water equals about a run of half a kilometre. When the lift is higher than 50 m the jog becomes even an uphill run. It is understandable that lifting water is not the favourite pastime for the beneficiaries.

Further handpumps tend to break down frequently when used under these conditions. Therefore for very deep installations it is advisable to check alternative options for water lifting. It might be more appropriate to have one solar system than to have several handpumps installed on very expensive boreholes that are not used or broken down.

4.1. General Recommendations

Choice of pumps

The results from this performance evaluation indicate that there would be no need for UNICEF do not change its choice of handpump types. UNICEF has been using India MKII pumps with good results for the last 12 years in West Africa. Only in recent years other types (Vergnet, UPM) have been added. The use of these other pumps does not bring any significant

advantages. It can be recommended that UNICEF carry on using India MKII and MKIII pumps in its projects if the installations are less than 45 metres. For installations of 45 m and more handpumps should only be used if other options are not considered feasible. If a handpump is used in this conditions the UPM seems to be a viable option.

The choice of handpump technology should however be governed by the situation around UNICEF projects. If in one country an other type of pump is prevalent and a functioning service network has been established for this type it would make sense to follow suit and purchase the same pump. It needs to be remembered that experience shows after sales services are directly linked to sales of new pumps. Spare part supply and after sales services stop if the supplier has no chance of selling his product any more.

In many West African countries the question of replacing pumps that were installed 10 and more years ago arises. For the rehabilitation of pumps in UNICEF projects it is not recommended to change the handpump type. If India MKII were employed with good success there is no need for change. The old pumps do have a considerable salvage value or do not need to be completely replaced, e.g. the pumpbase is in nearly all cases also after 10 years in good shape, to retain it will save all the work on the concrete. The rehabilitation should take the experiences made over the last few years into account. It might be necessary to utilize SS rod and pipes or it might be useful to switch over to India MKIII.

Procurement

It is strongly recommended that UNICEF should change the policy of procurement. If the pumps are purchased locally UNICEF can be instrumental in maintaining or setting up local capacity to produce and maintain the pumps. Local representatives of imported pumps or local manufacturers should sell the handpumps as turnkey installations. This means the contract to sell pumps should include: delivery and installation of pumps, training of area mechanics and village pump care takers, guarantee, supply of spare parts and technical back up. The initial cost of the pumps will be higher than for pumps purchased in bulk through Copenhagen. On the other hand the project can set up a much simpler internal structure if it does not have to involve itself in the organization of the installation and in the training. The benefits from such a procurement policy are that on local level private enterprises will provide services that are not dependent on one project only. In this way a sustained support to the communities in supply of spare parts and technical back up can be maintained. The initially higher cost for the pumps will be by far outweighed by the savings gained through local capacity building.

Rehabilitation

In all African countries a vast amount of money lies idle. Hundreds of expensive boreholes are not utilized because the handpumps are broken down. A borehole should have a service life of 25 years and more handpumps need to be replaced after about 10-12 years. Many of these boreholes could be rehabilitated for relatively small sums. It is therefore highly recommended that UNICEF includes the refurbishing of old boreholes in their projects. Since most of the UNICEF boreholes were fitted with India MKII pumps it would make sense to salvage as much as possible from the old pumpheads and cylinders. Such an action would again make the involvement of local supplier useful as it is difficult to preplan the amount of material needed.

4.2 Exchange of Experience

UNICEF is a highly decentralized organization. WES projects differ from country to country and especially from the French speaking Africa to the English speaking part. Many valuable experiences are gained during the execution of the various approaches. It appears that at the moment sharing of such experiences is left to coincidence. It would be very useful if the project officers from West Africa could come together and discuss their work. A strong emphasis in such a meeting should be given to breaking down the language barrier. A lot could be learned from each other if the fear to rub shoulder would be removed. For this reason any such meeting would need to be carefully planned and run in a way that would allow non-bilingual to participate.