Plan
West Africa

An Action Research for increasing effectiveness and sustainability in water and environmental sanitation

Bafata Region Guinea Bissau

Final Report

Acronyms	
APRODEL	Local environmental NGO
EU	European Union
SERNAP	**S**aude, **E**ducaçao, **R**ecursos **N**aturais, **A**PRODEL, **P**lan.
SWOT	Strengths, weaknesses, opportunities & threats
WES	Water & environmental sanitation
WHO	World Health Organisation

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1 Executive Summary

At the request of the West African Regional Office of Plan International an action research was undertaken into increasing effectiveness and sustainability in water and environmental sanitation (WES) in the Bafata Region of Guinea Bissau.

The Action Research was undertaken by an integrated team of professionals from the Guinea Bissau Government departments of Health, Education and Natural Resources in conjunction with the local NGO, Aprodel and Plan International, and with assistance from two international consultants.

The Action Research was carried out from January to March 2005 in 12 villages selected on a semi-randomised basis, to reflect the range of communities that exist in Bafata Region.

Participatory approaches were used in 'Evaluation Clubs' a hybrid of the Health Club model developed in Zimbabwe, with the intension of generating ownership of the findings and action on the ground.

The following Matrix presents a summary of the research questions, the findings and the recommendations:

Research Questions	Findings	Recommendations
Identify critical issues that influence access to and use of water supply and environmental sanitation	Access to Water: 75% have access to safe water however massive variation exists, and even where a safe source exists in a village people may not be using it because: 1. They live closer to an unsafe source 2. They don't have to pay to use the unsafe source 3. The safe source has the taste of iron Access to Sanitation 68% have no access to sanitation, and even where latrines do exist they are often in a poor condition. Projects have failed to deliver effective sanitation interventions to households or schools	The responses Plan and its partners can make are: For water: 1. Initiate a programme of low cost up-grades for traditional wells to make them more hygienic and safe to use. 2. Increase the number of safe communal sources 3. Where iron is a problem in ground water invest in wells rather than boreholes. For Sanitation: Initiate an enhanced programme of health education and latrine construction involving separate female and male teams of builders/ sanitation promoters, with the knowledge to build/promote either conventional or eco-san latrines.
Examine water security at household level	Water security at household level is 'basic' by WHO standards. With average consumption of 10 litres per person per day and time taken for household collection between 1and	Further work is needed to make safe water more easily available and thus to decrease further the distance people have to walk to safe water sources.

	2.5 hours per day, health concern status is 'high' by WHO standards[1]	
Analyse the causes of poor maintenance of facilities	Most water facilities in good working order, maintenance workers available, contracts exist between technicians and Plan assisted villages. However communities perceive 1. Poor levels of water committee management. 2. Lack of transparency in management of water fund. 3. Women often feel excluded from decision making. 4. Spare parts are difficult to find on the market and as a result costly. 5. Small number of maintenance workers causes delays in repairs.	Plan and its partners can assist by 1. Setting up an integrated support team from local government to help communities address their problems of poor management, lack of transparency and gender exclusion as well as other problems related to health education. (SERNAP) 2. Establishing a revolving fund system for spare parts sales through the Bafata office of the Ministry of Natural Resources until the private sector can be shown as able to take this over sustainably. 3. Train more maintenance workers from the communities to reduce delays in repairs.
Study the underlying causes of low impact on hygiene behaviour	Not enough vibrant and pro-active health and hygiene education provided at schools or in the villages.	A more joined up approach to health and hygiene education with new health clubs established in the villages and at schools to provide structure and with direct outreach links to the health education programmes on the local radio station to enthuse and spread the word.

[1] G. Howard & J. Bartram, 2003. Domestic water quantity, service level and health. WHO Geneva.

2 Introduction

Guinea Bissau is one of the smallest and poorest countries in West Africa. According to the UNICEF and the World Health Organisation[2] only 49% of rural families in Guinea Bissau have access to safe water and 34% to adequate sanitation. Diarrhoeal diseases rank as the second major cause of child morbidity after malaria.

Bafata Region is a low-lying area covering 13,600km², or approximately 1/3 of Guinea Bissau's total land area. It lies 149km to the east of the capital Bissau, and has a population of around 185,000 people living in 873 settlements. Most of these villages have some form of safe water source, usually a hand pump fitted to a borehole or a well.

Plan International's programme in Guinea Bissau started in 1996 and has concentrated in Bafata Region, where its programme has assisted all the regions 203 schools[3]. Efforts in the provision of safe water supplies have included the construction of 134 safe and improved water points for communities and schools, 96 equipped with hand pumps and 43 with pulleys and buckets. Work onsanitation has included the training of community latrine construction teams in each of the regions six divisions or sectors.

The Bafata action research into water and environmental sanitation was undertaken to:

- Identify critical issues that influence access to and use of water supply and sanitation
- Examine water security at household level
- Analyse the causes of poor maintenance of facilities
- Study the underlying causes of low impact on hygiene behaviour.

And to reach these objectives using processes which involved stakeholders in the ownership of the finding

In order to undertake the action research a partnership of Government departments (Education, Health and Natural Resources), a local non-government organisation, APRODEL, was formed with Plan international.

[2] UNICEF/WHO MDG mid term assessment report, 2004.
[3] 72 government schools, 90 community schools and 41 madrassas

It also involved the participation of two international consultants, Trish Anderson from Emery University in the USA and Brian Mathew from the UK.

The action research was initiated in December 2004 with a reconnaissance visit by the Plan Regional WES Advisor for Plan West Africa and the lead consultant. This was followed by an initiation and training workshop in January 2005 (see appendix 4 for training report), and by six weeks of intensive fieldwork involving 12 villages in the Bafata Region of Guinea Bissau. Village selection was on a semi-randomised basis, with the intension of obtaining a representative sample. Thus: village population, ethnic group and presence or lack of facilities such as schools, health centres and water supply technologies were used to obtain as general a sample as possible.

A dual approach of 'action research', and formalised household survey methodologies were applied. At the end of the research a summary of the findings was presented back to the villages by the integrated SERNAP[4] teams who were involved in conducting the research. These summaries, called the 'village data validation report forms' can be found in Appendix 1.

3. Methodology

3.1 Action Research

Action research has been described as *"an approach that emphasises the social responsibility of the investigator to get involved in research that really matters to the people who will be affected by it. It promotes a participatory style of cooperative searching, learning, and action in which all concerned benefit from the respective strengths each brings to the process. Action research, might be described as the epitome of a democratic research process, i.e., of the people, by the people, and for the people, with 'expert' assistance provided when needed"* (S. Kemp, 1998[5]).

Action research helps communities to analyse their situation and then chart their own way forward. It does this by providing them with a methodological 'avenue' to analyse the problems of the past and focus on the way ahead. It does this in a way that gives all a voice, the young and the old, the male and the female, the rich and the poor. The maxim is 'no research without action', and as such it is intended to be revolutionary, empowering and continual. It is about life and the life of communities, about reflection and reaction, about not only generating robust responses to the problems and dilemmas communities face, but about the ability of communities to be able to continue to do this long after the researcher has left. The dynamic ingredient is to include open reflection, partnership and 'people power'.

3.2 Evaluation Clubs

[4] SERNAP refers to the first letters of each department or NGO involved in the action research, thus: **S**aude, **E**ducaçao, **R**ecursos **N**aturais, **A**PRODEL, **P**lan.

[5] Sharon F. Kemp, University of Minnesota, as quoted in 'Introduction to Action Research – Social Research for Social Change', Davydd J. Greenwood & Morten Levin, SAGE Publications, London 1998.

Evaluation clubs were set up in each of the twelve villages selected for the research. This approach was chosen to help create a vibrant and dynamic relationship between beneficiaries and research staff, generating a feeling of ownership and commitment to the research and to reflection learning and action within each community. The concept of the evaluation club was developed from the Health Club method as used in Zimbabwe to promote structured health education in villages.

3.2.1 Chronology of the Research

The first point of contact with the villages was during the 'pre-visit' when the research teams met to discuss and ascertain the interventions of Plan and other agencies with the village leadership. The research timetable and logistics were discussed with the village leadership, and information was collected on water points, schools, interest groups and the most vulnerable, such as orphans and female-headed households.

The second visit to the villages was to undertake a session of participatory village mapping.. This was used to initiate the large-scale participation of the village and to reveal population distribution, use of water and sanitation facilities and traditional places used for defecation. The communities were divided in separate groups for men, women and children in order to allow all to have their chance to express their feelings and thoughts. The mapping was followed by joint sessions where representatives voiced the perceptions of each group. Transect walks were then used to verify the information, with GPS units used to plot facilities, so that they could at a later stage be entered into a GIS of the village.

At the end of the village mapping session the concept of the evaluation clubs was introduced. It was explained that at four subsequent weekly sessions action research would take place to investigate four fundamental areas:

1. The effectiveness of WES intervention in the village
2. The level of empowerment and involvement of communities in WES activities
3. The sustainability of WES interventions
4. The perceived impact of WES activities and action planning for the way forward.

All who attended the evaluation club sessions were issued with a club card. These cards had a place for the members name and village on the front. Inside the card the four sessions were marked in sections, then signed by the facilitator of each group at the end of each session to verify the individuals participation, encourage regular attendance at all the sessions and so that a certificate could be issued to those who took part. In addition a list of suggested group activities and home improvements was listed on the back of the cards. See Appendix 2 for the evaluation club card

3.2.2 Participatory tools

Various participatory tools were used during the action research including:

- Community mapping
- Focus Group discussions with checklist questionnaires

- Pocket chart voting
- SWOT analysis
- Target chart exercise
- Why mother gets tired exercise
- Line exercise
- Three pile sorting
- Action planning matrix

In addition, team members were asked to reflect at the end of each session and to record their perceptions of the outcomes of the days work.

Details of all the club sessions including: the day structure sheets, checklists and tool descriptions can be found in appendixes #A to #F.

4. Validation

A high level of participation by primary stakeholders was encouraged with 1,212 people joining the evaluation clubs over the six weeks of the research, including 605 men, 607 women and 362 children. This amounts to 0.9% of Bafata region's population.

5. Findings

The findings of the action research are expanded under headings the of the four evaluation club sessions.

5.1 Effectiveness

The operational and cost effectiveness of technology options for water and sanitation and training programmes in Plan and partner organisations was investigated with: village mapping, gender and child based focus groups using checklists, a SWOT analysis and pocket chart voting.

As a first gauge of effectiveness all of the 27 water schemes in the 12 villages were found to be working. Of these 21 had hand pumps fitted to boreholes, three hand pumps fitted to hand dug wells, and three solar powered submersible pumps fitted to boreholes with overhead tanks and distribution systems. In terms of use, 93% of these schemes are used for obtaining safe water for drinking and cooking requirements, 89% are used for bathing, 85% are used for laundry, 44% are used for watering livestock and 30% are used for watering gardens.

Table 1. Villages and their water points

Name of Village	Donor agency	Water Source type	Pump type	Completed	Population
Dou Haire	Plan	BH & HP	INKAR	2002	220
Gantauda	EU8FED	BH & HP	Vergney 3C	2004	2100
Gantauda	EU	Solar BH & Distribution		2004	2100
Bigine	EU	Solar BH & Distribution		2004	2734
Bigine	EU	BH & HP	Vergny 4C	2002	2734
Bigine	Saudi Arabia	BH & HP	INKAR	1986	2734

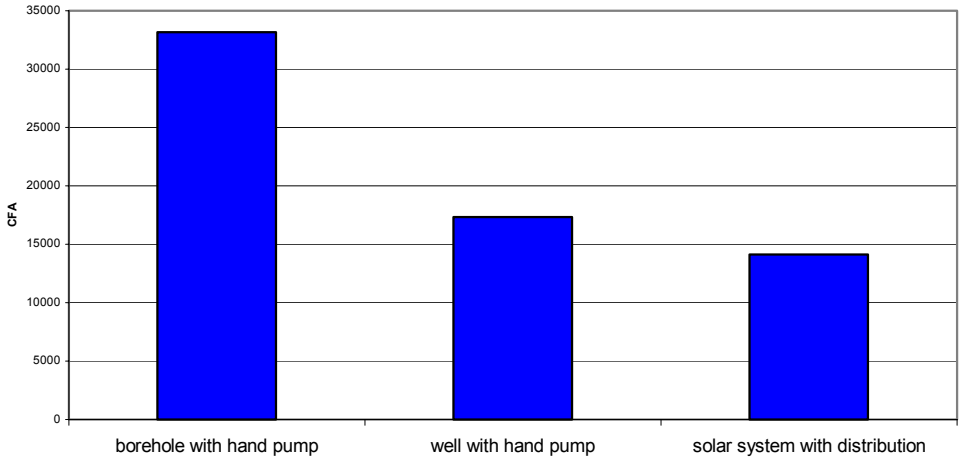
Cuntuba	Plan	Well HP	INKAR	2004	3845
Cuntuba	EU 8FED	BH & HP	Vergney 3C	2004	3845
Cuntuba	Kuwait	BH & HP	KARDI/INKAR	1997	3845
Cuntuba	UNDP	BH & HP	INKAR	1985	3845
Cuntuba	EU 8FED	BH & HP	Vergney 4C	2004	3845
Buntumchum	UNICEF	BH & HP	KARDIA	1996	600
Buntumchum	Dept Nat Resources	BH & HP	INKAR	1986	600
Watchico	Plan	BH & HP	INKAR	1998	120
Watchico	Plan	BH & HP	INKAR	1998	120
Samba Hogo	Plan	BH & HP	INKAR	1998	90
Samba Hogo	Plan	BH & HP	INKAR	1998	90
Sare Meta	EU	BH & HP	Vergney	2004	312
Madina Alfa	Plan	Well & HP	INKAR	2004	200
Mato de Cao	Plan	BH & HP	INKAR	2003	450
Mato de Cao	EU 8FED	BH & HP	INKAR	1996	450
Mato de Cao	EU 8FED	BH & HP	Vergney 3C	2004	450
Mamadjam	EU & NR	BH & HP			700
Mamadjam	EU & NR	BH & HP			700
Bagingara	EU	Solar BH & Distribution		1996	1200
Bagingara	Saudi Arabia	BH & HP	INKAR	1984	1200
Bagingara	Plan	Well & HP	INKAR	2003	1200

5.1.1 Per capita costs

The cost implications of various water systems to villages need to be addressed by both villagers and donors alike, prior to installation. All systems require maintenance but the ease of finding spare parts, being able to pay for them, and having skilled staff that can do this differs according to the technology.

Three main types of technology have been installed in the communities that took part in the Action research. These are boreholes equipped with INCAR or Vergney hand pumps, hand dug wells equipped with hand pumps, and more extensive water distribution systems equipped with solar powered submersible pumps, a rising main to an overhead storage tank and a small network of distribution pipes connected to domestic stand pipes, and in one case a cattle trough. Dividing the costs of the installations by the populations benefiting in the 12 villages researched gives the following per capita cost for these systems (Fig 1)

Fig 1. Average per capita costs of project facilities from Bafata Action Research 2005



Given that the unit price of solar systems[6] is higher than for boreholes or wells equipped with hand pumps, but they can cater for much larger numbers of people (2000+ people for solar systems as opposed 250 people per hand pump), a analysis of the installation costs indicates a cut off point for population size below which it is un-economic to install solar systems. On the basis of the current costs this appears to be 1,900 people for wells with hand pumps and 1,000 people for wells with hand pumps.

Box 1 The Cuntuba example

Cuntuba is a large village, of 3,845 people. It currently has four boreholes and a well, all fitted with a variety of handpumps. On the basis of 1 handpump per 250 people it is currently under supplied by 66%.

Cuntuba's evaluation club indicated keenness to have a solar system. This could be part of a valid solution, as currently the village would need at least 15 hand pumps to provide an adequate service, three times more than they have at the moment.

On the basis of current prices, a solar distribution system would cost around half as much to install as ten additional handpumps fitted to boreholes, and around $12,000 less than ten new wells with hand pumps.

Estimated cost of systems using current prices
1 x Solar distribution = US$66,219
10 x boreholes with handpumps = US$136,860
10 x wells with handpumps = US$78,900

[6] Average cost of solar systems in Bafata CFA33,573,150 or US$66,219

a) Handpump systems
The cost of hand pump systems in Guinea Bissau appears to be high. It is suspected that this results from a lack of competition, as there is only one importer, "ASCON" of hand pumps operating in the country which also doubles as the main installer of hand pumps. The average cost of a borehole and hand pump is CFA6,938,622 or US$13,685. The amount budgeted by Plan in their 2000 – 2005 CPO was US$12,000 for a borehole with hand pump and US$7,000 for a well with a hand pump. Comparing these costs to those in other parts of Africa the prices in Guinea Bissau appear high. For example in Southern Africa a borehole fully installed with a hand pump is estimated to cost not more than US$5,500 and a well with a hand pump around US$3,200. (REC1) As part of an economic analysis Plan should look at the cost of the direct purchase and importation of INKAR pumps, and at drilling costs from elsewhere in the West African region.

Table 2. A comparison of prices for boreholes & wells with handpumps

	From Bafata	Bafata	Southern Africa[7]
	CFA	US$[8]	$US
Borehole with hand pump	6,938,622	13,686	5,500
Well with hand pump	4,000,000	7,890	3,200

5.1.2 Functioning of systems
All the evaluation club focus groups reported currently good levels of functionality of the hand pumps and other water systems in their villages, although one of the solar systems had blocked pipes (Bagingara, see below).

Repairs however took some time to be made. Of the 7 breakdowns recorded during the research (all hand pumps), 1 took a week to repair, 3 took a month to repair, and 3 took three months to repair. The average cost of these repairs to the village was around CFA29,500 or US$51. All of the schemes were reported as being perennial.

In the 12 villages 5 hand pumps were recorded as being no longer in use. These had either been superseded by newer systems (solar), suffered from installation problems (borehole collapse), or in one case had been damaged beyond repair during maintenance some years before.

a) INKAR Handpump
(REC 2)The 'INKAR' hand pumps installed by Plan, appear to be generally favoured by users especially women compared to the 'Vergney' handpump, . For this reason as well as ease of maintenance (mechanics seem to prefer to work on the INKAR) its use should be continued. Other channels for the purchase and importation of INKAR pumps should however be investigated.

[7] Prices averaged from Zimbabwe 1998 prior to the economic collapse
[8] US$1 = CFA507 Oanda.com 10/04/2005

b) Wells and handpumps
Two villages (Bagingara and Cuntuba) commented on how they found wells with handpumps offered greater water security than boreholes, as water could be drawn by hand if there was a problem with the pump. (REC 3) Approximately half the traditional wells researched during this exercise run dry during the year, provided the project wells don't, they may offer a better solution to villages, especially if they do not suffer from iron contamination, which discourages people from using boreholes. A study of project wells across Bafata Region to establish if they have water throughout the year would be useful to Plan and its partners in deciding the future strategy for technology selection.

c) Solar distribution
Two of the three villages with solar distribution systems were working well (Gantuada and Bigine), however the third, Bagingara, which had its scheme the longest since 1996, had particular problems related to its associated iron reduction system. Iron oxide build up in the tank had led to the stand pipes becoming blocked through lack of maintenance. (For more details on this please turn to Bagingara's 'village data validation form' in Appendix 1). Solar systems are potentially more challenging to maintain than hand pumps. It would only take the theft of the solar panels for example to take a solar system out of action, and attempts to do this have happened in the past.
The cost and availability of new panels would then become two issues which could keep a solar system out of action for a long time.

Another problem of solar systems noticed by the women in Gantauda and raised during the evaluation club SWOT analysis, is that they produce less water on cloudy days, and this emphasises that careful design is required in order to size solar systems properly.

5.1.3 Ease of maintenance, costs and availability of spare parts

a) Mechanics and contracts
Of the 8 villages assisted with water installations by Plan, all had a maintenance contract with a local mechanic who charged agreed rates for their work. However this was only for the Plan interventions.

The effort that has gone into training local mechanics in hand pump repair has obviously paid off, as evidenced by the fact that most of the hand pumps installed over the past ten years are still in working order. Even where contracts don't exist communities have been able to find mechanics to assist them on a one off basis. Mechanics who had been trained on the INCAR pump were less able to undertake repairs to the Vergney pump however. (REC 4) Future training for mechanics should enable them to undertake repairs on all types of hand pumps. More mechanics should be trained to reduce the delay in undertaking repairs to hand pumps. The average distance members of water committees from the 12 villages had to travel to find a mechanic was 20km, the furthest being 60km and the nearest 2km.

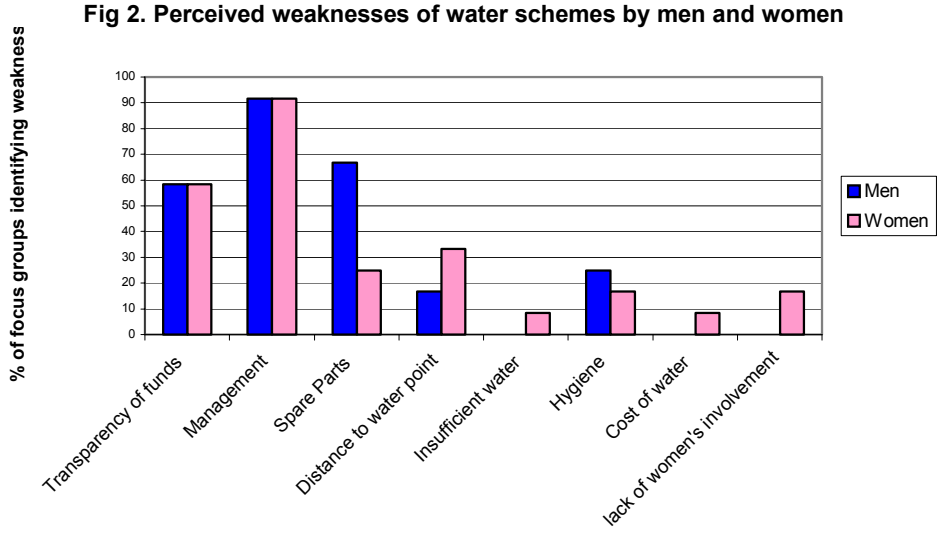
b) Spare parts

Along with training, arrangements were made for local suppliers to stock and sell spare parts for the handpumps. Lists of prices for these spare parts were issued to villages and mechanics to ensure that villages were not over charged. However the marketing of parts through the private sector does not seem to have worked, storing slow moving parts for possible future sale does not seem to have been profitable enough for storekeepers. Thus with new spare parts no longer available from local storekeepers, the mechanics have been forced to improvise and find second hand parts. With a shortage of spare parts available, prices for second hand parts have risen above the recommended prices for new parts. (REC 5) Plan and its partners need to address the issue of spare parts urgently, possibly by selling new spare parts through the office of the Department of Natural Resources on a revolving fund basis, at least until a reliable free market system can be re-established and be shown to work reliably. Generally all communities reported being able to afford the cost of repairs and spare parts in the past, though this may become problematic if non-availability forces the prices of spare parts up further. With solar systems two of the systems are fairly new and still in their guarantee period, there was however little or no knowledge of what spare parts might cost in the future or where they might be available from, this should concern the donor, the EU.

5.1.4 User views on effectiveness

Perceptions by men and women of how they judge the effectiveness of their water schemes were gauged by a SWOT analysis[9]. The results of part of this analysis are displayed below in the form of a bar chart, a score being given each time a thematic area (transparency of funds, management, spare parts etc.) is mentioned

Fig 2. Perceived weaknesses of water schemes by men and women



[9] SWOT Analysis stands for Strengths, Weaknesses, Opportunities and Threats

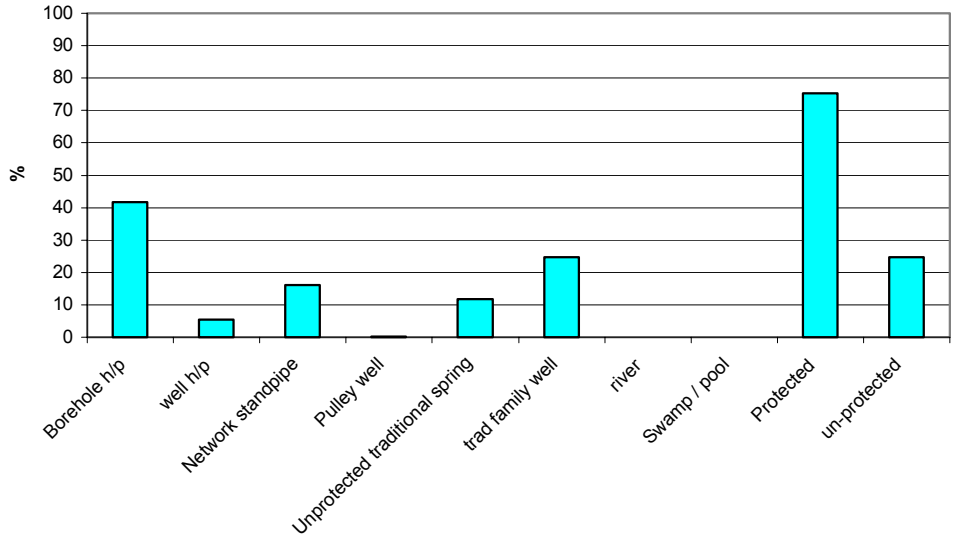
Weakness in the management of water schemes was strongly felt by almost all the evaluation club focus groups whether male or female. Likewise, weak management was regarded as the principle threat to continued operation of the schemes. Specifically, lack of transparency in use of water funds was mentioned by almost 60% of evaluation clubs. Women at several schemes felt that they were not properly consulted or informed of financial matters. Men regarded obtaining spare parts as a problem, with 67% of male focus groups registering this concern. Women as the main carriers of water registered the distance to safe water was an issue in 33% of schemes as at Dou Haire, Sare Meta, Matao de Cao and Mamadjam villages. In the case of the later the iron contamination in the village boreholes meant people had to walk to other water points. Other problems noted to a lesser degree included insufficient water, cost of water, and hygiene at water points.

5.1.5 Relevance of the technology options and of other options that could be included

a) Water use

A pocket chart voting exercise was carried out to determine which water sources people used for what purposes. From this exercise it was established that 75% of people prefer to use protected sources for their drinking water, and this shows the relevance of the value of the safe water sources. If all uses of water including water for cooking, washing, laundry, livestock are included then the proportion using improved sources drops to 67% with 33% preferring to use traditional sources.

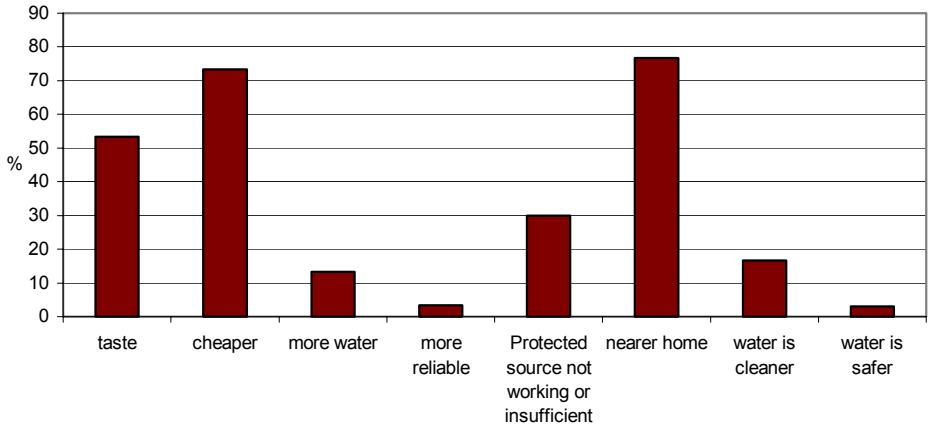
Fig 3. Use of protected and un-protected water sources for drinking



Of those people who preferred to use traditional un-protected sources instead of improved sources the focus group discussions revealed the following (also shown in Fig 4 below): Distance was, overall, given as the most important factor, with some of the people in 77% of the villages indicating that it was a

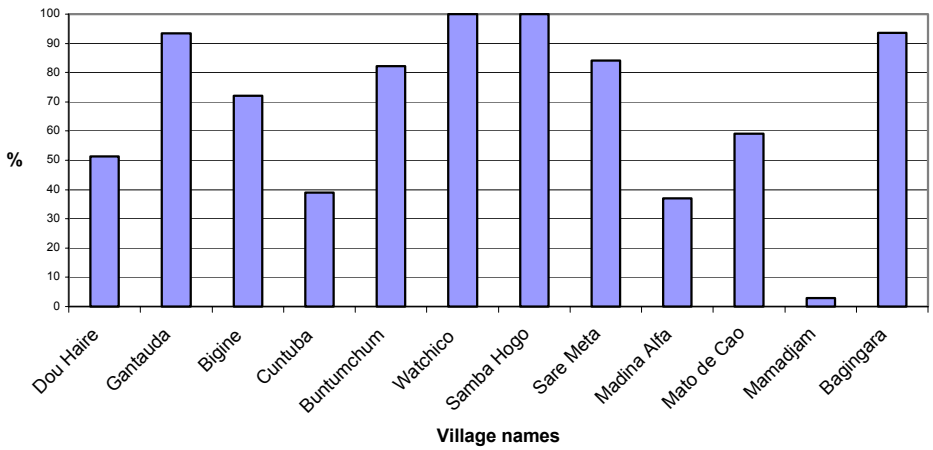
reason for using a traditional source rather than a safe source of water. The next most important factor was cost, and in 73% of villages this response was recorded (fees of some kind are usually payable for using safe water sources to pay for maintenance and repair. This does discourage some people from using safe sources). Taste was also a factor, especially where water from boreholes was heavily contaminated with iron, and people in 53% of the villages reported it as a reason for using a traditional source rather than an improved source.

Fig 4. Reasons given for using traditional wells in preference to improved water sources



Analysing the proportion of people using safe water village by village, one can see that each village is different, as Fig 5 (below) illustrates. The reasons for these differing patterns of use safe water use are related to the specifics in each village and for further insight please refer to the individual village data validation forms in the Appendix 1.

Fig 5. % Using protected water source for drinking



Mamadjam village for example has specific problems with major iron contamination of both of its boreholes, and even the installation of iron reduction systems on the boreholes appears to have failed to solve this problem. And As a result only 3% of respondents indicated that they used the protected water sources for their drinking water.

b) Other technology options

(REC 6) Where iron contamination is a major problem as in the case of Mamadjam village, a future strategy might be the up-grading of the existing traditional wells.This would protect water of known and acceptable taste from biological contamination, and thus encourage greater safe water use. Negotiation with well owners and the wider community would be needed to ensure that all were content with such an arrangement. Techniques known in the region for deepening[10] and protecting the wellheads with concrete aprons and ring walls could then be used, with either hand pumps or pulley wells installed for water abstraction.

The situation in the villages of Dou Haire, Cuntuba and Madina Alfa seems largely to be related to problems of those people living in certain parts of the villages which are further from safe water point, and are as a result reluctant to trek to collect the water and to have to pay for it. The people living in these areas prefer to use traditional wells that are closer to their homes and free of charge (is that the case?). A programme of up-grading these traditional wells might thus also be relevant here as well as Mamadjam.

c) Gender and child differences over the use of safe and unsafe water

Dis-aggregating the data by focus group into results for men and women showed that a greater proportion of women (29%) reported using un-protected water as drinking water sources than men (24%). However since it is the women who usually collect water for the home it may be safe to assume that the proportion of men using unprotected water sources for drinking will in fact be the same as for the women. The data for children was less reliable as children only took part in the pocket chart voting exercise in three villages (Mamadjam, Mato de Cao & Buntumchum). Collectively the results from these villages indicated that as many as 45% of children may be using un-protected sources for drinking water. If the data for Mamadjam (as it was iron contaminated) is removed this drops to 33%, which still indicates a need for targeted health education for children on the importance of using protected water sources rather than un-protected traditional sources.

d) Time saving

One of the benefits of the new protected water systems appears to be the time saved by women and children who collect the water, and this is another indication of the relevance of the project. This is because many of the new systems are closer to homes than the old traditional sources. The following

[10] The issue of deepening improved wells would have to be addressed as 52% of the traditional wells run dry during the last few months of the dry season and stay dry on average for four months.

table of data collected at nine of the villages[11] during the mapping exercises illustrates this.

Table 3. Time collecting water in minutes

Village	Time before	Time after	Time saving
Gantauda	90	10	80
Bigine	60	30	30
Buntumchum	120	30	90
Watchico	120	15	105
Samba Hogo	120	10	110
Sare Meta	60	10	50
Madina Alfa	120	15	105
Mato de Cao	45	12.5	32.5
Babingara	30	15	15
Average	85	16	69

The average of 69 minutes of time saved per trip equates to an 80% reduction in time spent collecting water. With an average household size of ten people, and daily per capita consumption of around 10 litres per person per day[12], five trips (each carrying 20litres) are required to collect water for the household each day. With each trip taking 16 minutes this gives an average collection time per household of 1hr 15 minutes each day.

The action research however contrasts with the data from the household survey, which indicates a smaller time saving of around 15 minutes a day, and a total household water collection time of 2 hrs 51 minutes in the dry season and 2 hrs 10 minutes during the wet season.

One of the reasons for the differences in the figures above may be multi sourcing of water, with people using safe water sources for their drinking water requirements (which they often have to pay for) and traditional sources which are usually further away (but free) for other household requirements. The fact that the household survey indicated a difference of nine minutes per trip between the dry season and the wet season indicates the use of traditional sources, which often dry up during the dry season, for at least part of the household requirement.

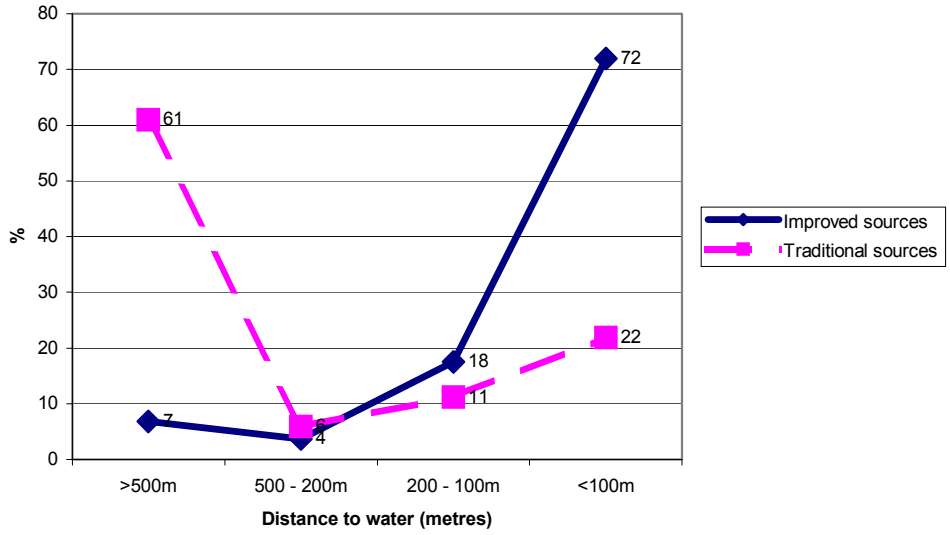
The claim of time saved by the presence of new safe water points would appear to be backed up by the data on distance to water points obtained during the village mapping, illustrated in Fig. 6 below. In the graph the larger proportion of people walking the shortest distance appears to be for those who go to the improved water points. For example 72% of those who walk to safe water sources, walk less than 100m as opposed to just 22% of those who walk to traditional sources. Some people do walk distances in excess of 500m to safe water sources, though these appear to be in the minority. This

[11] data on time saving for the remaining 3 villages was not recorded

[12] P. Anderson, Household survey results. 2005. A research study for increasing effectiveness and sustainability of Plan International's West African WES Programmes

data would also appear to triangulate with the information on water source use, with 75% using improved sources for drinking and around 25% still using traditional sources often because of the distance.

Fig 6. Overall % of people walking to protected and un-protected water sources by distance



e) Traditional water sources

Other options for technology could include the up-grading and protection of existing traditional water sources. 29 Traditional water sources were recorded during the course of the action research. Of these 4 were springs and the rest privately owned traditional wells. 72% of these traditional water sources were used by at least some members of the community for drinking, with 86% being used for cooking purposes, 97% for bathing and laundry, 66% for watering livestock and 28% for watering gardens.

The four springs at Gantuada, Sare Meta and Mamadjam had been used for many generations and no systems had been introduced to protect them. This was a missed opportunity because not only are they a health risk , but with improvement and protection they could be harnessed to provide a secure water source for a large population. In Gantuada for example, the larger of the two springs yields around 20 – 30 litres per second on a perennial basis, most of which runs to waste.

Some of the traditional wells have also been used for a long time, with one dating back to 1932. In their current state, they produce un-hygienic water, are often dangerous, and their top structures in poor state of repair. They also often run dry during the year (52% were recorded as non-perennial by the evaluation clubs). A programme of traditional well improvement could be launched to improve all these aspects and make traditional wells an asset rather than a risk (see REC 4).

5.1.6 Effectiveness of sanitation and hygiene interventions

a) Present situation
Data on sanitation coverage in the 12 villages was obtained from 3 sources, the focus group discussion on sanitation effectiveness (#C4) the village mapping (#B2) and the school data collection exercise (#A2). The average sanitation coverage figure for the 12 villages is 32%[13].

The figures for sanitation coverage do not correspond with their use however, as even where coverage appeared to be fairly high, such as in Samba Hogo and Madina Alfa, the standard of construction left much to be desired. Children were often afraid to use the latrines because of the large holes in the floors, preferring to use the bushes or the areas around the home instead.

Table 4. Sanitation coverage by village

Village	% Sanitation Coverage
Dou Haire	27
Gantauda	6
Bigine	61
Cuntuba	9
Buntumchum	43
Watchico	42
Samba Hogo	67
Sare Meta	32
Madina Alfa	75
Mato de Cao	27
Mamadjam	21
Babingara	38

b) Previous work
Despite some work by Plan and the MoH to train and introduce latrine construction, little appears to have been achieved on the ground. Only two of the twelve villages reported receiving assistance to build household latrines and this was only done in small numbers (Plan and WHO being the donors in question).

For the majority that do not have a latrine (68%), open defecation is the main alternative. Table 5 gives an indication of where people defecate.

Table 5. Places used for defecation by those without latrines

	All	Men	Women	Children
Use neighbours latrine	26%	16%	40%	4%
Use bush less than 500m from home	50%	57%	39%	77%
Use bush more than 500m from home	19%	25%	14%	0%
Use cat method	5%	3%	6%	19%

[13] The sanitation coverage was worked out by dividing the known number of latrines in each village by the number of households, this was then weighted by the population of each village to give as accurate a figure as possible.

c) Diarrhoea

With so many people defecating in the bush many cases of preventable diarrhoea are occurring. Transportation for the sick to hospital in Bafata is difficult even at the best of times with around 1% of the entire population of Bafata requiring hospital treatment for diarrhoea each year[14]. Of these 65% are children under five years of age.

Table 6 Percentages requiring hospital treatment due to diarrhoea[15]

Year	% of entire population	% under 5yrs old
1999	1.51%	70%
2000	0.98%	73%
2001	1.07%	63%
2002	0.97%	65%
2003	0.79%	59%

d) Opportunities for action on sanitation, and past experience

(REC 7) A big opportunity exists for a new sanitation project with 83% of the village evaluation clubs including sanitation in their action plans, more than any other single requested intervention.

(REC 8) Clearly any campaign to introduce sanitation would do well to consider the factors that currently influence people to build household latrines (Table 7). Combined experience at school and health education appear to have accounted for just 19% of the latrines that have been built compared to 81% that have been influenced by socio cultural factors. In addition to enhancing health education in the community and at schools it might thus also be appropriate to enlist the help of religious authorities, and also to use social marketing to 'sell' the idea of latrines and improved life styles, to make the ownership of a household latrine an aspiration for the masses.

Table 7 Factors that influenced those that have latrines to build them

Reason to build a latrine	Percentage
Religious and cultural reasons	34%
Family pressure	28%
Peer pressure	19%
Health education	10%
Experience of using a latrine at school	9%

At the meetings, 89% of adults showed interest in building a latrine. 38% said the reason they had not built a latrine was the cost of the materials, 23% blamed the lack of availability of materials and 19% said they had no knowledge of how to build a latrine. A project that provided appropriate health

[14] The numbers of people requiring hospital treatment for diarrhoea was the only indication available from the MoH, much larger numbers can be expected to be suffering in the villages out of reach of medical facilities.

[15] MoH data from Bafata Regional Hospital 1999 - 2003

education on the need for sanitation, materials in the form of a floor slab, and guidance on how to build a latrine, stands a good chance of success.

e) Effectiveness of school sanitation

Sanitation at schools is poor. Of the nine villages with schools in the action research area only three had latrines for the children. In two of these cases there was only one latrine to share for both boys and girls. In the third case (Babingara School) there was one latrine for girls and one for boys. In the fourth case, children from Watchiko who attend Gamamudo School, are not able to use the latrines because they collapsed during a heavy rain storm in 2003, indicating both a poor level of construction and a low priority for re-building the latrines by both the school and the community. Four of the schools had hand-washing facilities for the children, but only 3 schools claimed to have hygiene education classes, although 75% of children reported having had some form of health education from school.

f) Health education

The Plan funded community radio station 'Radio Comunitaria Bafata', broad - casting on FM105.5Mhz is clearly a success, with many claiming to have heard and learnt about health and hygiene from the radio. According to the household survey 79% have received information on diarrhoea from the radio. (REC 9) To energise health education a suggested approach would be to transform the evaluation clubs into health clubs. The health club approach (pioneered in Zimbabwe) offers participants a structured course of health education, which has been proven to change behaviour. In this approach health clubs are formed separately for adults and children, membership cards are distributed and people are encouraged to attend weekly sessions on 15 health topics, with a number of tasks suggested for hygiene improvement at home. Participatory 'PHAST' methods and tools are used in the teaching. The membership cards are signed by the facilitator after each session to verify participation, and so that those that attend all the club sessions can receive a certificate to recognise their achievement. Work on sanitation and well up-grading could also be linked to the clubs. (A sample heath club membership card is included in Appendix 6). The health clubs could then be linked up with interviews and radio broadcasts on the community radio station to create a vibrant movement for improved health practices across Bafata Region.

5.2 Empowerment

The second session of the evaluation clubs focussed on the empowerment of communities, their roles in decision making, in management and maintenance issues and the effectiveness of the support networks in assisting management and maximising impact. To assess empowerment, three main tools were employed including:

1) Separate focus group discussions for men, women and children.
2) The 'target chart' exercise to establish involvement in specific elements of the project cycle.
3) The 'why mother gets tired' exercise to raise the issue of the workload of women, and the implications for their involvement in other activities

5.2.1 Community and individual degree of choice

From the evaluation club focus group discussion work on empowerment, half of the women's focus groups (6 villages) claimed that their community had chosen the water technology, and a quarter (3) of the men's focus groups felt this way. Those groups that claimed they had made the choice of technology said that they had been given adequate information to make the choice. When evaluation clubs were asked about whether they had been involved in problem identification, selecting the solution, implementation, management and evaluation, a much higher proportion claimed involvement. This indicates that efforts were being made by project staff to involve communities even if they were not always given the role of selecting a particular solution.

Table 8. The proportion of evaluation clubs claiming involvement

	Men	women	Both men and women
Problem identification	100%	92%	96%
Selecting the solution	100%	75%	88%
Implementation	100%	83%	92%
Management	100%	100%	100%
Evaluation	92%	75%	83%

5.2.2 Effectiveness of water management committees

In the evaluation club SWOT analysis of project effectiveness doubts were expressed over the management capacity of water management committees , especially in the area of finance. In the context of the evaluation club focus group discussions on empowerment however, these doubts were not voiced, probably because management committee members were present at the meetings and it would have seemed rude to confront them, especially first thing in the morning (this was one of the first points addressed). As a result almost all the management committees received an endorsement of their effectiveness, with the exception of Babingara where the men were forthright enough to say that they were not effective.

5.2.3 Necessary structures and institutions to train and support community management in the long term.

Training of management for village water committees has not been strong in the past. 54% of the evaluation clubs knew of some management training given to the water committees., However where this did happen it seems to have been offered in the short term only, with a two day course in basic maintenance, hygiene and accounts. Most management committees appear to have been formed at the time the system was installed and to have continued from then without further elections.

In one case only men were elected to a management committee (Bigine). For the most part however there appears to have been gender parity with two men and two women on each committee. There does even seem to have been an effort to ensure, on the projects part, that whilst the chair of the committee is almost always a man, the treasurer is a woman. The reality however is that female treasurers, usually have to hand over any money they hold to the chairman. As a result there seems to be confusion over who the

treasurer is. To illustrate this, in half the cases researched (6 villages) the men's and women's focus group discussions differed in their perception of whether the treasurer was a man or a woman. The men remembering that a woman was selected treasurer, whilst the women knew that if a woman had been selected she was seldom allowed to actually act in this capacity.

This indicates that while there have been attempts to train communities in balanced management, cultural practices, which tend to exclude women from power, have in many cases prevailed. Support structures for community management once schemes are working do not seem to exist. Communities are left to get on with the management of their scheme and thus often revert to traditional systems of hierarchy.

(REC 10) A need exists for a support structure capable of meeting with water committees on a regular basis to discuss their problems and help them find solutions . This structure should be based in local government and formed possibly from the SERNAP groups involved in the action research.

5.2.4 The role of women in stages of the project cycle from problem identification through to selecting solutions

In attempting to qualify and quantify the level of women's involvement in the schemes this analysis concentrates on two pieces of evidence: a) the recorded reflections of the field staff and b) the target chart exercise in which individuals were asked to demonstrate their perceived level of involvement in several stages of the project.

a) Reflections of the research teams

In the recorded reflections of the research teams, women were often portrayed as being relegated to subservient roles, cooking at meetings for example, with the main decisions being taken by the men. In some villages women were more vocal and empowered. The exercise of the evaluation clubs themselves, with separate meetings for both men and women appeared to help both to question and consider their position. This approach of separate parallel meetings could be used in the future with joint plenary sessions held to share ideas between the sexes.

The comments in Table 9 below are taken directly from the reflections of the research teams after their sessions on empowerment and illustrate the current situation.

Table 9 Research Teams Reflections on Empowerment

Village	Research Team Reflections
Gantauda	women cook, collect water, and were involved in selecting the sites for the standpipes, they were also involved in fund raising for the maintenance and cleaning the stand pipes
Bigine	Women were involved almost in all things although in some, their involvement is less seen.

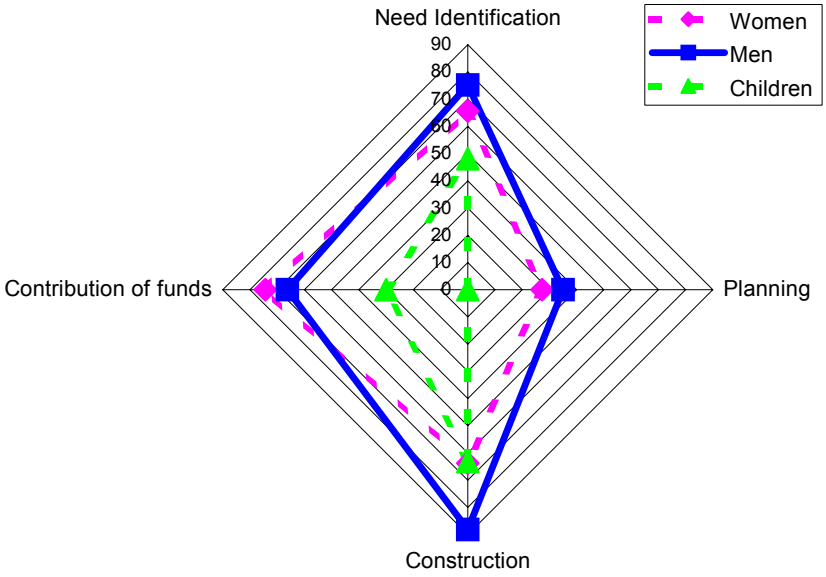
Cuntuba	Women are not involved in all diction making, but they do participate in other things like cooking, find water for people working in the project. The women, clam that there is no transparency managing funds by Men. They would like the men to be trained to change their mentality about not involving the women in funds management.
Buntumchum	Most of time the women are involved in project implementation but some times not, because to their strong submission to the men
Watchico	women in this community are always informed and involved in all activities, including making decisions. Although, in some of them, their involvement is less. For this reason the men should be given training in order to get women more involved.
Samba Hugo	Women are not involved in all decision making, but they do participate in other things like cooking, finding water for people working in the project. The women, claim that there is no transparency managing funds by Men. They would like the men to be trained to change their mentality about not involvement of women and funds management.
Sare Meta	The women were not involved in problem identification, finding solutions, or choosing type of technology, because Men think they should decide for them.
Madina Alfa	Women are not involved in all decision making. They do participate in other social activities for development, and they were involved in sharing information about the funds.
Mato de Cao	The women are involved in all processes, including identification, evaluation and functioning of the project.
Mamadjam	Most of time the women are involved in project implementation but some times not because of their strong submission to the men
Bagingara	The women are only involved in the implementation of the project not the process.

b) Gender and child perceptions of involvement in elements of the project.

In the target chart exercise, members of the evaluation clubs were asked to say to what extent they felt they were involved in various aspects of the project. (The results of this exercise are shown in Fig 7).

Men generally perceived slightly more involvement in project need identification, planning and construction than women, with women regarding their role in the contribution of funds as being slightly more than men. Only 40% of the men and 30% of the women regarded themselves as being involved in project planning. Perhaps not surprisingly children portrayed their role as less influential than either the men or the women, assigning themselves no involvement whatsoever in planning.

Fig 7. Perceived involvement in elements of the project cycle



5.2.5 The involvement of children in hygiene education

According to the adults in 75% of the villages covered by the survey, children are receiving health education mostly from school, and this is done on a weekly or monthly basis. According to the children in the target chart exercise, 36% receive a lot of hygiene education, 29% receive a medium amount while 10% have received some hygiene education, making 75% overall receiving some level of hygiene education. (REC 11) Whilst some hygiene education materials have been donated to schools in Bafata Region by Plan, a new more dynamic programme involving the setting up of health clubs at the schools, building on the children's involvement in the evaluation clubs, with a link to the Community Radio Station in Bafata, might help to energise this and make health and hygiene for children a bigger priority in Bafata Region, and make it more fun at the same time (see REC 9 for more details on health clubs).

5.2.6 Government sector policies and strategies

The evidence in the villages of government policies and strategies in the WES sector were illustrated firstly by the fact that most villages had a safe water point of some kind, the fact that there has been some standardisation of pump types, basically either INKAR or Vergney, has also helped to promote some level of standardisation vital to the provision of spare parts throughout Bafata Region. Current problems of availability of these parts can be solved in the future by greater involvement of the government in facilitating availability and regulating quality of parts.

(REC 12) The department of Natural Resources is primarily responsible for water resources and currently its department is under funded and under resourced. Its staff are however enthusiastic and capable and have been active within the SERNAP teams involved in the research. A future strategy might be to enhance this partnership and cement their involvement in SERNAP, along with the departments of Education and Health, and the NGOs APRODEL and Plan. An integrated approach to strategy will help to ensure that gaps are not missed and a common approach to policies, for example in promoting sanitation at schools and the wider community, receives the interdepartmental support it deserves and needs.

5.2.7 Community and family level investment in their own water supply

(REC 13) Many of the villages have traditional wells, built by families but open for all to use. The average cost of one of these wells was estimated at CFA121,071 (US$239) and the average time taken to build was given as 36 days. The best time to dig them was the end of the dry season when the water table is at its lowest. The expertise to build such wells existed in two of the twelve villages. The possibility of offering subsidies on materials to up-grade traditional wells has already been discussed in the effectiveness section on traditional wells. Given the skilled manpower that exists in many villages, such an approach, if scaled up, could help communities access better water facilities, through a massive process of traditional well up-grading across Bafata Region.

5.3 The sustainability of water and sanitation systems

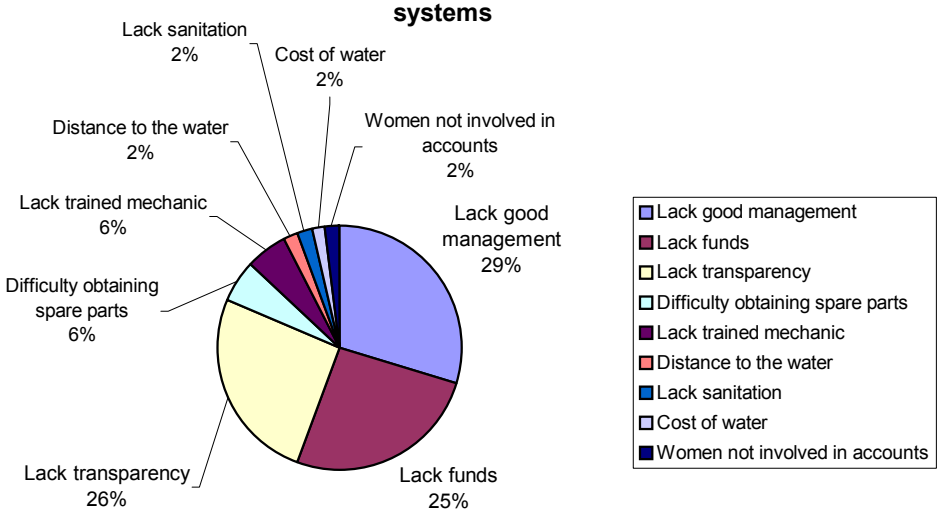
The tools used to investigate sustainability were focus group discussion sessions on water and sanitation and a second SWOT exercise specifically aimed at sustainability.

The results from the SWOT analysis for sustainability of water systems raise nine factors as weaknesses. Five of these weaknesses stand out above the others and need to be addressed as they keep recurring. These are:

- Lack of good management
- Lack of transparency
- Lack of funds
- Difficulty obtaining spare parts
- Lack of trained mechanic

If these issues can be dealt with sustainability will be assured.

Fig 8.SWOT analysis of weakness factors for sustainability of water systems



The system for setting up contracts with mechanics mentioned in section 5.2 has helped to provide a technical support structure for the water schemes, but one which can be improved with more mechanics and greater availability of spare parts. The majority of villages see themselves as running their own affairs and paying for their own repairs, which implies a commendable degree of self-sufficiency. (REC 14) The lack of support structures, especially for making available spare parts for purchase is worrying however, and Plan and its partners in government need to address this before it develops into a crisis. As already mentioned, training more mechanics in the maintenance of all the pump types is also needed in order to reduce delays in maintenance and provide the community with a larger pool of qualified technicians to work with.

5.3.1 Resources necessary to provide sustainable maintenance for water systems

In order to establish sustainability of water systems the action research endeavoured to assess the following:

- Are the systems currently functioning?
- Are people prepared to work together to keep them functioning?
- Are the funds raised by the communities, to pay for repairs and maintenance, sufficient to keep their water facilities functioning?

The simple answer to all these questions was yes. With two partial exceptions that will be explained later, all the systems were functioning and providing a service that was valued by the users. The people had elected committees to manage the maintenance of the systems, and nine of the twelve villages currently had water funds. Those communities that did not have water funds

were either prepared, or had in the past, raised funds when needed to undertake repairs to their water systems.

The two partial exceptions were Mamadjam, and Bagingara. In the case of Mamadjam high levels of iron contamination in the ground water meant that few people used their two boreholes for domestic purposes, the pumps were however both in working order. In Bagingara failure to conduct regular maintenance had led to the blockage of the stand pipes. Further details of both these village schemes can be found in the village data validation forms in Appendix 1.

More detailed discussions with the evaluation clubs revealed varying rates of charging for water (see Table 10 below for rates). The principle that the water schemes (hand pump or solar) cost money to maintain and repair seemed to be well established.

Table 10. Rates charged for water by village water committees

Village	System of charging	Rate CFA	Rate US$ / m³
Watchico and Cuntuba	Per 25ltr bucket	CFA 25	$1.97
Bigine and Gantuada	Per 25ltr bucket	CFA12.5	$1
Mato de Cao and Samba Hogo	Per month	CFA 500	$0.33
Dou Haire	Per month	CFA 400	$0.26
Madina Alfa	Per month	CFA 200	$0.13
Sare Meta	Per month	CFA 100	$0.07

The question remains over what the economic rates to charge for water in order to assure sustainability are. The answer to this depends on two key variable factors 1) the cost of the repairs and maintenance, 2) the number of people who are able or willing to pay for them. The rates are thus going to differ both from village to village, and over time as generally aging systems will require more expensive and frequent repairs than newly installed systems.

Analysing the data provided by the evaluation clubs it is possible to get an idea of what has been paid out in the past and thus what a reasonable subscription should be both for current maintenance costs and future replacement costs.

Table 11. Estimating the household fee required to cover repairs and maintenance costs for handpump systems per month.

Average costs for hand pump repair per year	CFA 29,583
Cost per family per year (Divided by 25 families[16])	CFA 1183
Cost per family per month	CFA 99

[16] Household survey results indicated an average of 10 people per household

The table above indicates that a household subscription of approximately CFA 100 per month for a village of 250 people should cover the average repair costs. However if the replacement costs are added, on the basis that a hand pump will have a 15 year life span after which it will need to be replaced, then the following would have to be raised:

Table 12 Estimating the household fee required to cover the repairs, maintenance and replacement costs for handpump systems per month.

New borehole and hand pump	CFA 7,500,000
Over 15 years cost per year	CFA 500,000
Cost family per month (25 families)	CFA 1,667
Including cost of repairs (CFA 99 from table above)	CFA 1,766
Cost of water per m³ (At current consumption rates of 10ltrs per person per day 3m³ per family per month)	CFA 589
Cost of water per m³ in US$	US$ 1.16

Table 12 shows the real cost of water from a hand pump as being around six times more than the cost of repair and maintenance on their own.

5.3.2 Barriers to sustainability and ways to overcome them

Raising the full cost of a hand pump over this time frame also requires that the funds are kept secure, so that they can be used in the future. The question of transparency of water fund management now becomes extremely important for this to work. Keeping the water fund at the home of the treasurer is no longer realistically feasible. The money needs to be banked.

The focus group discussions revealed that 67% of the evaluation clubs did not know how much money was in their water fund, and of the groups that did know 57% were male and 43% female groups. Eight villages out of the twelve had water funds ranging in size from CFA1,370,750 (US$2,704) for one of the solar systems (Bigine) to CFA3,000 (US$5.92) for the village of Sare Meta, with a borehole and hand pump.

Comparing what villagers say they are already paying for water with what is held in their water funds also often appears to leave a gap. The following table attempts to quantify this using estimates of income from the action research and comparing it to the actual water fund.

Table 13 Estimates of income generation by water committees

			current	Estimated	Estimated	Estimated	CFA
		Number of	Cost	Monthly	monthly	Yearly	held in
Name of Village	Population	Households	$m3	income[17] US$	Income CFA	Income	water fund
Dou Haire	220	22	0.26	8.58	4,350	52,201	12,500
Gantauda	2100	210	1	315.00	159,705	1,916,460	450,000
Bigine	2734	273	1	410.10	207,921	2,495,048	1,367,700

[17] calculated on the basis of a typical family consuming 10ltrs per person per day and sourcing half of this water from the improved water source.

Cuntuba	3845	125	1.97	369.38	187,273	2,247,278	88,000
Buntumchum	600	60	0	0.00	0	0	0
Watchico	120	12	1.97	35.46	17,978	215,739	42,000
Samba Hogo	90	9	0.33	4.46	2,259	27,104	5,500
Sare Meta	312	31	0.07	3.28	1,661	19,931	25,600
Madina Alfa	200	20	0.13	3.90	1,977	23,728	110,000
Mato de Cao	450	45	0.33	22.28	11,293	135,521	45,000
Mamadjam	700	70	0	0.00	0	0	0
Bagingara	1200	120	0	0.00	0	0	0

In only one case in the table above has the amount held in a village water fund exceeded the estimated yearly income of the water system. The average age of each installation is 6 years and 5 months and a degree of accumulation of the water fund would be expected on an annual basis after repairs and maintenance had been paid for.

The evaluation clubs raised the issue of transparency of water fund management at a number of stages. Women in particular felt they were often left out of financial matters, and there were doubts expressed by some evaluation club members of the security of water funds.

(REC 15) It is recommended that training is given in transparent accounting, and that the CENFA savings scheme operating in Bafata is investigated as both a source of training expertise and as a possible location for holding water fund savings accounts. Currently two villages hold their water funds at CENFA, Gantuada and Bigine. The Manager of CENFA Sr. Mutaro Tuncena suggested that 3 to 4 days should be sufficient training for those who are numerate while between 1 and 2 weeks might be needed to give accounts training for those who are not.

5.3.3 Willingness to pay for water

As can be seen above willingness does exist to pay for improved and safe water supplies. Factors that mitigate against paying for safe water are: distance, especially if there is a traditional water source closer to the home, the level of cost and the taste of the water. People are for example reluctant to use let alone pay for water that tastes of iron.

5.3.4 Reasons for use and non-use of water supply

These were largely dealt with in the section above 5.1 and are related to (by order of importance) distance, cost and taste.

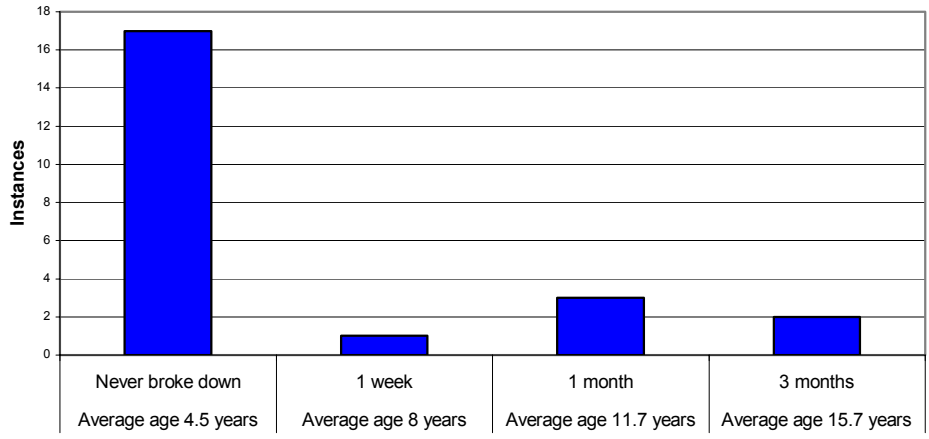
5.3.5 Potential link to productive water use and sustainable livelihoods

Half of the villages taking part in the exercise agreed that added income from the use of water for productive purposes might also help to pay for their water system and secure its sustainability. Such water uses included market gardening, livestock watering, wine making and palm oil extraction. The logic being that those who can in addition to their domestic requirements augment their livelihoods through use of the water should also contribute more to the maintenance and replacement costs of the water installation.

5.3.6 Reasons for breakdown and reasons for repairing or delaying repair to water systems

Breakdowns when they occur seem to be for the usual reasons of wear and tare, significantly more serous breakdowns occurring with older pumps than newer pumps as indicated by the time it took to repair them see Fig 8 below

Fig 9. Handpump performance against age and time it took to undertake last repair



5.3.7 Scope for widening technology options including both higher and lower cost solutions.

This topic has been largely dealt with under section 5.1.2.a (Technology costs). The suggested options are for more mechanically sophisticated technologies (such as solar systems) with larger populations and for hand dug wells with either hand pumps or pulley systems for smaller communities. The option of utilising local well digging expertise, and of up-grading traditional wells would also significantly save costs and allow a rapid scaling up of access to safe water.

(REC 16) Lower cost solutions: Traditional well improvement project:
Suggest builder teams are formed and trained in techniques for deepening traditional wells during the dry season, also in building: headwalls, concrete aprons and pulley systems to provide protection and ease of water abstraction. The emphasis must be on safety at all times with safety helmets and safety boots being worn by all those working inside wells to prevent head injury from falling materials, implements etc.

5.3.8 Sanitation Sustainability

As already seen, sanitation coverage in the research villages is around 32%. 80% of those who currently have latrines indicated that they would build another latrine when their existing one fills up. 67% said they would use materials from the old latrine to do this and 13% said they would purchase new materials. This indicates that once a household becomes used to having a latrine they will not generally want to revert to not having one, and it shows

the sustainability of the sanitation concept. The average cost of a latrine, priced by those who have built one, was CFA15,091 (US$30). Most people used locally available materials in the construction including poles, stones, sand, empty sacks, and reed fencing (see recommendation below)

a) Ecological Sanitation ECO-SAN

Ecological sanitation was introduced to the evaluation club members as a form of sustainable sanitation that could also be used to help sustain soil fertility in kitchen gardens. The following results were taken directly from the focus group discussions.

50% of participants at the evaluation clubs had kitchen gardens, 62% of those with gardens kept produce for themselves and their families, 36% sold produce from these gardens. 54% had difficulty in maintaining soil fertility in their gardens and used animal manure to keep the gardens productive. 34% of the participants had their own livestock to provide this manure. For those without livestock the majority could get manure from their friends and neighbours. 22% said they knew how to compost kitchen waste for their gardens. Those who had to pay for manure for their gardens paid between CFA500 (US$1) and CFA12,500 (US$25) for it per year. 1% (9 people) said that they were aware of composting human faeces and using it as a fertilizer, only one person said they used the method. At the end of the sessions 51% said they were interested to try eco-san. 30% were not at all interested.

(REC 17) A sanitation pilot project, with separate teams of male and female builders/ sanitation promoters, trained in latrine construction methods, and offering either i) conventional household latrine with 3 metre pit, or ii) shallow 1 metre deep eco-san version.

- Plan to provide cement and metal reinforcement mesh, training and tools for making concrete san plats wide enough (1m² diameter) to cover the pit (0.8m²diameter).
- Other materials: sand, gravel and water to be provided by householders along with building fee (to pay builders) in cash or kind. Initial work to be undertaken at the homes of the trainee builders (so no need to pay building fee).

i) Conventional latrine to be fitted with simple one hole san plat and cover for hole. Reed fence circular surround installed to provide privacy with overlap so no need for door.

ii) Eco-san latrine, to be constructed as conventional latrine but with pit only dug 1m deep.

A similar reed fence surround used as for the conventional latrine.

- A mixture of soil (40%), leaves (40%) and ash (20%) to be added every time the latrine is used. This will prevent flies from breeding in the pit and promote composting of the contents.
- Once pit 75% full, new pit to be dug in close proximity (pit should last 6 months to one year before filling).
- Sanplat then removed and installed on new pit along with reed surround.
- Old pit covered with soil from new pit excavation to fill in top of hole and left for 6 months.

After leaving for 6 months householder can either decide to dig up contents, which will by now be composted and safe to put on the kitchen garden, or householder can plant a fruit tree on the pit which will then benefit from the nutrients. In the last case a new pit will have to be dug each year and a tree planted each time.

5.4 Evaluation of impact from the household perspective.

The tools used to judge impact were a) the line exercise, b) 3 pile sorting.

5.4.1Water security at the household level

The household survey indicated a low level of water consumption of around 10 litres per person per day. Although low and less than half the UN minimum standard of 25 litres per person per day, this amount is common in many communities across Africa even where water supplies have been up-graded and protected. Evidence suggests that not until water is available in the yard will consumption drastically increase[18]. Health and hygiene education should play its part however, and the suggestion is that health clubs should be set up in all communities with both adults and children to make changes in behaviour possible.

Price of water has been dealt with in detail in the previous sections. Paying for water is an issue especially where people have to walk a distance to collect it, or where the water has an unpleasant taste. Paying for water is also an issue for the vulnerable and very poor who cannot afford to buy it and communities need to be able to face up to their own responsibilities of looking after those most in need.

5.4.2 Water quality at the point of consumption

The water testing equipment was not working during the research and so data could not be collected on this. (REC 18) It is recommended that future efforts to monitor the quality of water are coordinated with the ministry of health who have the necessary personnel and laboratory facilities to conduct these tests. Equipment should be repaired and handed over to the MoH and a programme developed for regular testing of water at both project and traditional water points to verify purity of the water in the improved sources and in the home, and at traditional wells, so that people can learn first hand of the dangers they face from drinking contaminated water.

5.4.3 Impact

The following results from the line exercise are presented in three pie charts, indicating how people in the evaluation clubs see the impact of the water schemes on their lives. The overall positive impact is gauged at 84% (Fig 10). Fig 11 draws on the comments of those who rated the impact as good. Their comments were grouped according to type and then counted. They revealed reduced sickness as being the biggest overall perceived impact marking up 71% of responses when combined with reduced diarrhoea. Reduced distance

[18] Cairncross S. 1987 The benefits of water supply. Developing World Water II (ed. J. Pickford) London, Grosvenor Press and White GF, BradleyDJ and White AU 1972. Drawers of water: Domestic water use in Est Africa. Chicago University Press.

was registered in 14% of cases, followed by perceived good quality of water 9% and good quantity of water at 6%.

Fig 10. Perceptions of evaluation club members of the impact of their water schemes

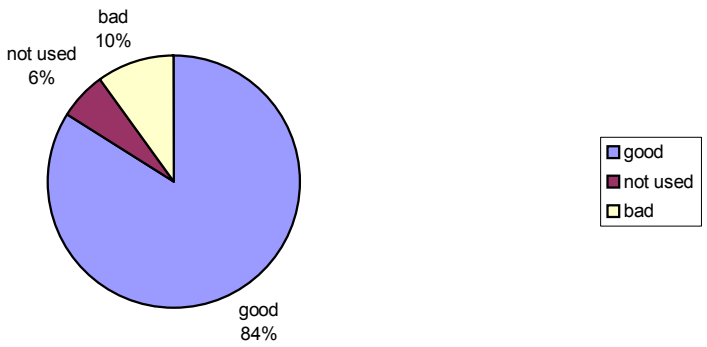


Fig 11. Reasons Evaluation Clubs gave for regarding their water project as beneficial

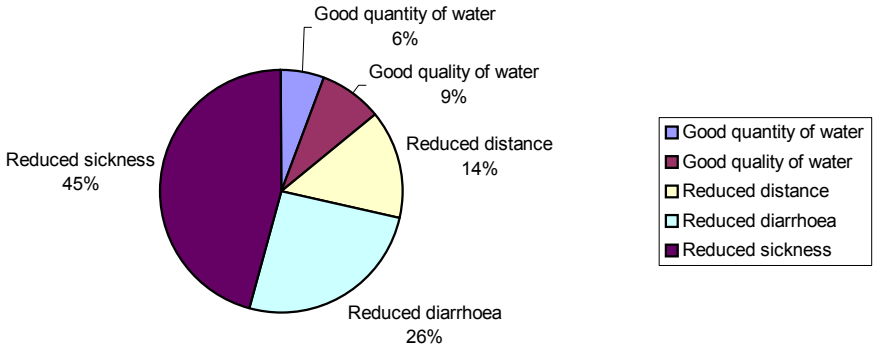
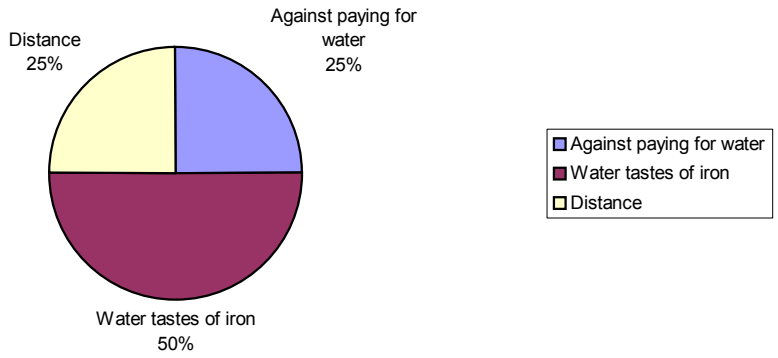


Fig. 12 Reasons for evaluation club members either not using a project water point or regarding it negatively



Where evaluation club members were either not using a safe water point or regarded it negatively the reasons were threefold, with iron contamination in the lead (Cuntuba, Buntumchum, Mamadjam & Bagingara) followed equally by distance to the new scheme (Bagingara Men and women) and payment for water (Bigine men & women).

6. Conclusions

The objectives of this final report were to critically analyse the findings of the Guinea Bissau Action Research into the existing strategies for effectiveness and sustainability of Plan's and its partners' approaches to the WES sector, and to present the findings and critical issues that influence:

- Access to and use of water supply and environmental sanitation.
- Water security at household level.
- The causes of poor maintenance of facilities.
- The underlying causes of low impact on hygiene behaviour.

This has been attempted in the preceding sections on effectiveness, empowerment, sustainability and impact. These findings and issues are now crystallised in the final conclusions.

6.1 Access to and use of water supply and environmental sanitation

6.1.1 Water

Access and use of water supply differs in each community. Overall access to and use of safe water is 75%, though this figure hides a massive variation from complete coverage to almost no coverage as is illustrated in Fig 5. Within communities that appear 'covered', because they have a safe water source, people may still be using un-safe traditional sources for three main reasons:

- They live closer to the unsafe source
- They don't have to pay to use the traditional source
- The traditional source tastes better and does not suffer from iron contamination.

The responses that Plan and its partners can make to this situation are:

- Initiate a programme of low cost up-grading for private traditional sources with the users/ owners to make them more hygienic and safe to use.
- Increase the number of communal safe sources with a new drilling or well digging campaign
- Where iron is a problem in deeper ground water, invest in wells rather than boreholes, either as above through up-grading traditional wells, or in sinking new communal wells. In either case greater levels of finance will be directed into the local economy to pay local well sinkers and builders and this will have a knock on effect on the local economy.

Projected water supplies have made a massive difference to the lives of the people in Bafata, cutting the distance people have to walk for water so that overall 72% have less than 100m to walk to a safe water source, and cutting the numbers of diarrhoea cases each year[19].

6.1.2 Sanitation

Access and use of sanitation facilities in Bafata Region is poor with only 32% of families overall having some kind of access to a latrine. The latrines that do exist are often in a poor state of repair and as a result are not being used by children. This means that at least 68% of the people, probably more, do not practice safe sanitation. Sanitation facilities at the schools in the research villages were also virtually none existent. Attempts by Plan and its partners to address this issue have not been effective in addressing the scale of the sanitation problem. This should not be seen as a criticism but as an opportunity for a new approach. Suggestions and recommendations have been made in the text as to how to bring this about (see RECs 7 &15 below). Briefly they include an expansion of pro-active health education activities using what is already happening through the Plan funded local radio station and linking this to health clubs in the communities and schools, and training separate teams of male and female builders to help provide two latrine options, 1) a conventional latrine and 2) eco-san 'fossa alterna' or arbour loo latrines.

6.2 Water security at the household level

Water security at the household level implies access to sufficient quantity and quality of safe water. In the context of Bafata Region the household research indicated that per capita use of water is low at around 10 litres per person per day. Average collection times at around 38 minutes per trip in the dry season and 29 minutes in the wet season result in a household spending over two hours each day collecting water[20], with women and children usually

[19] according to the evaluation clubs in 8 of the 12 communities

[20] P. Anderson 2005. Household Survey Results, A research study for increasing effectiveness and sustainability of Plan International's West African WES programme.

undertaking this task. According to the action research the average time for collecting water from safe sources was less, at around 16 minutes per trip, giving 1hr 15 minutes household water collection time. Even if this chore is split between several family members the service level is still classified as 'Basic access' and the level health concern is 'high' according to World Health Organisation Standards[21]. Further work is thus needed to make safe water more easily available and thus to decrease still further the distance people have to walk to safe water sources.

6.3 The causes of poor maintenance of facilities.

The statement above assumes poor maintenance of facilities is the status quo. Whilst this was often the case with latrines, most of the water facilities in the research villages were found to be in working order and providing a valued service to the villagers. The maintenance contracts promoted by PLAN between village water committees and local mechanics have been effective in keeping systems working, and where no maintenance contract exists most villages have raised fund on an as-needed -basis to have repairs made. The threats to maintenance, as perceived by the evaluation clubs, result largely from poor management, a lack of financial transparency within water committees, difficulty of obtaining new spare parts for pumps and a shortage of repair staff. Plan and its partners can help to address these problems by:

- Making sure that spare parts for pumps are available in Bafata, through a spare parts store and revolving fund at the Ministry of Natural Resources, until the private sector can provide a reliable and sustainable service.
- Providing training for more maintenance workers from the communities with expertise in both INKAR and Verney handpumps.
- and by establishing an integrated support team, similar to or evolved from SERNAP, that can meet with communities and re-energise water management committees and organise transparent accounts training, and establish health clubs in the villages.

6.4 The underlying causes of low impact on hygiene behaviour.

From the level of action observed on hygiene education in Bafata the reason that there has been low impact on hygiene behaviour, is that there has not yet been enough done to promote it. Health education at schools does not appear to have been pro-active and vibrant and whilst many villagers have listened to and taken notice of the health education messages broadcast on the local community radio (set up by Plan), it seems that much more could be made of this golden opportunity to outreach villages and inspire behaviour change. The approach of setting up health clubs in the community and at schools, from which the notion of the evaluation clubs themselves was derived, could inject life and enthusiasm into this important area. Rather than one off health messages, structured health and hygiene education could be linked with sanitation and well improvement in a new imaginative joint approach to make a change in every village in Bafata region.

[21] G. Howard and J. Bartram 2003, Domestic water quantity, service level and health. WHO/SDE/WSH/03.02 WHO Geneva.

6.5 The 'evaluation club' approach to action research.

The evaluation clubs excited a great deal of interest and enthusiasm in the villages, with 1,212 people participating. The clubs gave villagers the chance to debate and discuss WES issues on an equal footing with the thoughts of women and even children given equal importance to those of the men. The future mapping exercise in which children produced maps of how they would like to see their village in ten years time, when some of them are starting their own families, gave the adults much cause for thought, provision of improved facilities including sanitation being prominent on many of the maps. Action plans for the future were produced by the adults and in a number of cases inspired by the children's ideas. In these action plans the evaluation clubs discussed and conceived ideas to improve their villages, and thought about what they could do themselves to achieve these objectives and what they would need assistance to achieve. These ideas included, but also extended beyond WES.

What now exists in the 12 villages are communities ready for action to improve their lives. It is important that this wave of enthusiasm is used to build improvements on and it is hoped that the recommendations of this report will bear fruit, especially in the field of hygiene, sanitation and up-graded traditional wells.

6.6 Integrated teams 'SERNAP'[22]

The research was undertaken by two integrated teams from the Guinea Bissau departments of: Health, Education and Natural Resources, as well as staff from the NGOs APRODEL and Plan. The suggestion and hope is that the teams will be continued under the new title 'SERNAP' and given a new role of working with the villages in Bafata, with the evaluation clubs transformed into health clubs. The SERNAP teams could be used to assist villages with known management problems to help them confront these, so that solutions can be found. It is also suggested that the SERNAP teams become involved in setting up systems to improve financial management and transparency of water committees with the CENFA savings scheme operating in Bafata.

7. Recommendations

The list of recommendations extracted from the main text of the report, for improving the WES sector in Bafata, it is presented below by section.

7.1 Effectiveness

(REC1) As part of an economic analysis Plan should look at the cost of the direct purchase and importation of INKAR pumps, and at drilling costs from elsewhere in the West African region.

(REC 2)The 'INKAR' hand pumps installed by Plan, appear to be generally favoured by users especially women compared to the 'Vergney' handpump, . For this reason as well as ease of

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[22] SERNAP refers to the first letters of each department or NGO involved in the action research, thus: **S**aude, **E**ducaçao, **R**ecursos **N**aturais, **A**PRODEL, **P**lan.

maintenance (mechanics seem to prefer to work on the INKAR) its use should be continued. Other channels for the purchase and importation of INKAR pumps should however be investigated.

(REC 3) Approximately half the traditional wells researched during this exercise run dry during the year, provided the project wells don't, they may offer a better solution to villages, especially if they do not suffer from iron contamination, which discourages people from using boreholes. A study of project wells across Bafata Region to establish if they have water throughout the year would be useful to Plan and its partners in deciding the future strategy for technology selection.

(REC 4) Future training for mechanics should enable them to undertake repairs on all types of hand pumps. More mechanics should be trained to reduce the delay in undertaking repairs to hand pumps. The average distance members of water committees from the 12 villages had to travel to find a mechanic was 20km, the furthest being 60km and the nearest 2km.

(REC 5) Plan and its partners need to address the issue of spare parts urgently, possibly by selling new spare parts through the office of the Department of Natural Resources on a revolving fund basis, at least until a reliable free market system can be re-established and be shown to work reliably.

(REC 6) Where iron contamination is a major problem as in the case of Mamadjam village, a future strategy might be the up-grading of the existing traditional wells.This would protect water of known and acceptable taste from biological contamination, and thus encourage greater safe water use. Negotiation with well owners and the wider community would be needed to ensure that all were content with such an arrangement. Techniques known in the region for deepening[23] and protecting the wellheads with concrete aprons and ring walls could then be used, with either hand pumps or pulley wells installed for water abstraction. (the issue of deepening wells that are selected for up-grading would need to be addressed as 52% of the traditional wells run dry during the last few months of the dry season and stay dry on average for four months).

(REC 7) A big opportunity exists for a new sanitation project with 83% of the village evaluation clubs including sanitation in their action plans, more than any other single requested intervention.

(REC 8) Clearly any campaign to introduce sanitation would do well to consider the factors that currently influence people to build household latrines (Table 7). Combined experience at school and health education appear to have accounted for just 19% of the latrines that have been built compared to 81% that have been influenced by socio cultural factors. In addition to enhancing health education in the community and at schools it might thus also be appropriate to enlist the help of religious authorities, and also to use social marketing to 'sell' the idea of latrines and improved life styles, to make the ownership of a household latrine an aspiration for the masses.

[23] The issue of deepening improved wells would have to be addressed as 52% of the traditional wells run dry during the last few months of the dry season and stay dry on average for four months.

7.2 Empowerment

(REC 9) To energise health education a suggested approach would be to transform the evaluation clubs into health clubs. The health club approach (pioneered in Zimbabwe) offers participants a structured course of health education, which has been proven to change behaviour. In this approach health clubs are formed separately for adults and children, membership cards are distributed and people are encouraged to attend weekly sessions on 15 health topics, with a number of tasks suggested for hygiene improvement at home. Participatory 'PHAST' methods and tools are used in the teaching. The membership cards are signed by the facilitator after each session to verify participation, and so that those that attend all the club sessions can receive a certificate to recognise their achievement. Work on sanitation and well up-grading could also be linked to the clubs. (A sample heath club membership card is included in Appendix 6). The health clubs could then be linked up with interviews and radio broadcasts on the community radio station to create a vibrant movement for improved health practices across Bafata Region.

(REC 10) A need exists for a support structure capable of meeting with water committees on a regular basis to discuss their problems and help them find solutions. This structure should be based in local government and formed possibly from the SERNAP groups involved in the action research.

(REC 11) Whilst some hygiene education materials have been donated to schools in Bafata Region by Plan, a new more dynamic programme involving the setting up of health clubs at the schools, building on the children's involvement in the evaluation clubs, with a link to the Community Radio Station in Bafata, might help to energise this and make health and hygiene for children a bigger priority in Bafata Region, and make it more fun at the same time (see REC 9 for more details on health clubs).

(REC 12) The department of Natural Resources is primarily responsible for water resources and currently its department is under funded and under resourced. Its staff are however enthusiastic and capable and have been active within the SERNAP teams involved in the research. A future strategy might be to enhance this partnership and cement their involvement in SERNAP, along with the departments of Education and Health, and the NGOs APRODEL and Plan. An integrated approach to strategy will help to ensure that gaps are not missed and a common approach to policies, for example in promoting sanitation at schools and the wider community, receives the interdepartmental support it deserves and needs.

(REC 13) Many of the villages have traditional wells, built by families but open for all to use. The average cost of one of these wells was estimated at CFA121,071 (US$239) and the average time taken to build was given as 36 days. The best time to dig them was the end of the dry season when the water table is at its lowest. The expertise to build such wells existed in two of the twelve villages. The possibility of offering subsidies on materials to up-grade traditional wells has already been discussed in the effectiveness section on traditional wells. Given the skilled manpower that exists in many villages, such an approach, if scaled up, could help communities access better water facilities, through a massive process of traditional well up-grading across Bafata Region.

7.3 Sustainability

(REC 14) The lack of support structures, especially for making available spare parts for purchase is worrying however, and Plan and its partners in government need to address this before it develops into a crisis. As already mentioned, training more mechanics in the maintenance of all the pump types is also needed in order to reduce delays in maintenance and provide the community with a larger pool of qualified technicians to work with.

(REC 15) It is recommended that training is given in transparent accounting, and that the CENFA savings scheme operating in Bafata is investigated as both a source of training expertise and as a possible location for holding water fund savings accounts. Currently two villages hold their water funds at CENFA, Gantuada and Bigine. The Manager of CENFA Sr. Mutaro Tuncena suggested that 3 to 4 days should be sufficient training for those who are numerate while between 1 and 2 weeks might be needed to give accounts training for those who are not.

(REC 16) Lower cost solutions: Traditional well improvement project:
Suggest builder teams are formed and trained in techniques for deepening traditional wells during the dry season, also in building: headwalls, concrete aprons and pulley systems to provide protection and ease of water abstraction. The emphasis must be on safety at all times with safety helmets and safety boots being worn by all those working inside wells to prevent head injury from falling materials, implements etc.

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- Plan to provide cement and metal reinforcement mesh, training and tools for making concrete san plats wide enough (1m² diameter) to cover the pit (0.8m²diameter).
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7.4 Impact

(REC 18) It is recommended that future efforts to monitor the quality of water are coordinated with the ministry of health who have the necessary personnel and laboratory facilities to conduct these tests. Equipment should be repaired and handed over to the MoH and a programme developed for regular testing of water at both project and traditional water points to verify purity of the water in the improved sources and in the home, and at traditional wells, so that people can learn first hand of the dangers they face from drinking contaminated water.