Impact evaluation of drinking water supply and sanitation interventions in rural Mozambique

More than Water

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Mid-term impact evaluation:
UNICEF – Government of The Netherlands Partnership for Water Supply, Sanitation and Hygiene 'One Million Initiative', Mozambique

Preface

Drinking water supply and basic sanitation has been a priority for the Netherlands' development co-operation and for UNICEF for many years. Current attention is guided by the international consensus on the Millennium Development Goals (MDGs). MDG 7 includes the target to halve, by 2015, the proportion of people in 1990 without sustainable access to safe drinking water and basic sanitation.

Since 2006 the Netherlands supports UNICEF programmes through the UNICEF-Netherlands Partnership Programme for Water Supply and Sanitation. The biggest programme is the UNICEF/Government of the Netherlands/ Government of Mozambique water supply, sanitation and hygiene promotion programme "One Million Initiative" in rural areas in the provinces Manica, Sofala and Tete. Mozambique is both for the Netherlands and for UNICEF a partner country to which for many years substantial support to water supply and sanitary facilities has been provided.

The Policy and Operations Evaluation Department (IOB) of the Netherlands Ministry of Foreign Affairs and the UNICEF Evaluation Office, in close cooperation with UNICEF Mozambique, conducted a mid-term impact evaluation of the on-going programme. A follow up impact study is envisaged at the end of the programme in 2013.

The objective of the support to water supply and sanitary facilities goes beyond sustainable access to facilities: it aims to reduce the burden of water collection (typically a task for women and girls), improve health, raise school enrolment and attendance, improve livelihoods and, ultimately, reduce poverty. The for Mozambique innovative UNICEF Community Approach to Total Sanitation (CATS) made the study particularly interesting. Special attention is paid to drinking water quality at the source and at point of use and to linkages between water supply, sanitation and hygiene behaviour. In addition the report reviews some major challenges to reinforce sustainability.

There is a worldwide consensus on the impacts of programmes for water supply and sanitary facilities; conventional evaluation studies do not, however, normally quantify these. The impact evaluation has used a combination of quantitative and qualitative methods and techniques. Through such an evaluation both Evaluation Departments wish to explore how the effects of these programs can be measured. For the Netherlands the study is the fifth in a series of impact evaluations of water supply and sanitation programs in different countries.

Rita Tesselaar of IOB was overall responsible for the impact evaluation, in coordination with Samuel Bickel of the UNICEF Evaluation Office, and in close cooperation with Samuel Godfrey, head of programme at the UNICEF Mozambique Office and Mr. Americo Muianga, programme coordinator of the Directorate of Water, Government of Mozambique. The main research consultants for the study were Jan Willem Gunning and Chris Elbers, Professors of Development Economics at the VU University Amsterdam; Dr. Stephen Turner, senior consultant in Resource Development and Belis Matabire, national consultant in water supply and sanitation. The household, community and water point surveys were

implemented by the agency WE Consult, through the UNICEF Mozambique Office. The study benefited from information and comments on draft versions of the report received from the Directorate of Water, staff of the UNICEF Mozambique Office, Paul Eduards of UNICEF headquarters, Dr. Christine Sijbesma of the IRC International Water and Sanitation Centre, Antonie de Kemp and Henri Jorritsma of IOB, Dick van Ginhoven of the responsible policy department of the Netherlands Ministry of Foreign Affairs and Felix Hoogveld of the Netherlands Embassy in Maputo. Thanks are also due to all other informants and last but certainly not least, all the respondents to the survey questionnaires and participants of group interviews. Special thanks are due to the water supply and sanitation team of the UNICEF Mozambique Office for their information, advice and support throughout the study.

IOB and UNICEF Evaluation Office bear responsibility for the contents of the report.

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Contents

Tables

Figures

Abbreviations

AfDB	African Development Bank
ANC	antenatal clinic
ARA	Regional Water Authority
ASAS	Sector Support to the Water Sector
CAS	Water and Sanitation Committee
CATS	community approach for total sanitation
CDC	Centres for Disease Control and Prevention
CFS	Child-Friendly Schools for Africa Initiative
CFU	Coliform forming units
CLTS	community-led total sanitation
CRA	Council for the Regulation of Water Supply
CUT	Single Treasury Account
DALY	Disability-Adjusted Life Years
DAS	Department of Water and Sanitation
DFID	United Kingdom Department for International Development
DNA	National Water Directorate
DPOPH	Provincial Directorate of Public Works and Housing
FIPAG	Water Supply Investment and Asset Holding Fund
GAS	Water and Sanitation Group
GOM	Government of Mozambique
GON	Government of the Netherlands
GTAS	Water and Sanitation Thematic Group
HDI	Human Development Index
HDR	Human Development Report
IOB	Policy and Operations Evaluation Department
INE	National Institute of Statistics
JMP	Joint Monitoring Programme for Water Supply and Sanitation
LOLE	Law of Local Organs of the State
mln	million
MDG	Millennium Development Goal
MT	Meticais
nd	not dated
NGO	non-governmental organisation
np	no page number
O&M	operation and maintenance
ODF	open defecation free
PARPA	National Action Plan for the Reduction of Absolute Poverty
PEC	community participation and training
PESA-ASR	Rural Water Supply and Sanitation Strategic Plan
PHAST	Participatory Hygiene And Sanitation Transformation
PRONASAR	National Rural Water Supply and Sanitation Programme
PSU	Primary Sampling Units
SD	standard deviation

SDC	Swiss Development Corporation
SDPI	District Service for Planning and Infrastructure
SINAS	National Information System for Water and Sanitation
SISTAFE	State Financial Management System
SNV	Netherlands Development Organisation
STEPS	Social, Technological and Environmental Pathways to Sustainability
TOR	Terms of Reference
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
VCT	voluntary counselling and testing
WASH	Water, Sanitation and Hygiene
WEDC	Water, Engineering and Development Centre
WHO	World Health Organisation
WSP	Water and Sanitation Programme

Main findings and issues

In 2008 the Government of Mozambique, UNICEF and the Government of the Netherlands agreed to an impact assessment at mid-term and at the end of the Netherlands supported UNICEF Water Supply, Sanitation and Hygiene programme - the One Million Initiative - in Mozambique. This report is on the mid-term impact assessment.

The impact evaluation is a joint responsibility of the Policy and Operations Evaluation Department (IOB) of the Netherlands Ministry of Foreign Affairs and the central Evaluation Department of UNICEF. The evaluation is implemented with major support from the UNICEF Mozambique Office and the Government of Mozambique water sector authorities. Within the framework of a partnership between the Government of Netherlands, UNICEF and the Government of Mozambique, which aims at supporting the achievement of the Millennium Development Goals with respect to drinking water and adequate sanitation for families and schools, the Water Supply, Sanitation and Hygiene Programme – known as the One Million Initiative – is being implemented in 18 districts of Manica, Sofala and Tete provinces. The programme is to run for seven years (September 2006 – December 2013). It is expected that by the end of the programme

- one million people in the rural areas use safe drinking water, through the construction of new sources of water supply;
- 200,000 people use safe drinking water, through the rehabilitation of their sources of water supply;
- one million people use adequate sanitation facilities;
- 1.2 million people adopt appropriate hygiene practices;
- 400 primary schools (with a total of 140,000 pupils) use appropriate drinking water, sanitation and hygiene facilities;
- 18 districts and three provinces have strengthened technical and management capacities for the planning, coordination and implementation of programmes for water supply, sanitation and hygiene education.

The total budget for the programme is EUR 32.64 mln, of which 65% is provided by the Government of the Netherlands, 19% by UNICEF, 13% by the Government of Mozambique and 3% by beneficiaries. The programme implementation strategies are aligned with the national water policy, which places priority on meeting the basic needs of the disadvantaged, on decentralised management and on the participation of users. The programme is an important reference for the National Water Supply and Sanitation Programme (PRONASAR), which is now in its initial phase of implementation. Its approach is participatory and demand responsive, with user communities and schools expected to take leadership and responsibility for the maintenance and management of their improved facilities and behavioural change, supported by Government, NGOs and the private sector. The main water supply technology applied is a borehole fitted with a hand pump. An important component is the engagement of local NGOs to carry out promotion activities in the targeted districts to build demand for improved services, as well as capacity to sustain services and strengthen the supply side for the construction of latrines and maintenance

and repair of water points. The One Million Initiative revised its participatory sanitation and hygiene transformation (PHAST) strategy by merging education components with a community-led total sanitation approach, amended to a community approach for total sanitation (CATS). The implementation of water, sanitation and hygiene activities in the target provinces is complemented by the development and strengthening of government capacities at provincial and district level in order to ensure long-term sustainability of the interventions.

UNICEF Mozambique Office has reported that by the end of 2009 the One Million Initiative had rehabilitated a total of 392 water points, completing this element of its work plan (UNICEF, 2010a). By the end of 2010 it had built 994 new water points. The number of users enumerated at these new water points totalled 967744, implying an average of 974 users per water point, being still far above the national planning standard of 500 users per water point.[1] The number of users calculated on the basis of this standard would be 489500. On both accounts the figures indicate that the programme has made good progress in achieving its target number of beneficiaries.

The 2010 programme progress report further indicates that, following the replacement of the PHAST approach with a community approach to total sanitation (CATS), the programme has nearly reached its target of one million people using sanitation facilities. Over and above these planned targets, 433 communities with a total population of 349,243 have so far reported to be declared open defecation free (ODF). The performance of the schools component has been slower, although (again moving beyond the original strategy) 362 schools had been declared ODF to November 2010. The sanitation facilities created are mostly simple pit latrines made of local materials. The programme has reduced borehole construction costs from EUR 10,772 in 2008 to EUR 5,255 in 2010, although work in more difficult areas in 2011 may drive average costs up again. The CATS approach to sanitation involving total communities has significantly reduced the average cost of latrine construction, which is now estimated at EUR 7.62.

The overall purpose of this impact assessment is to account for support provided and to be a reference for programme management and for policy development. The focus of the assessment is on the impact of interventions on the welfare of the final beneficiaries. The ultimate purpose of the support provided goes beyond access to facilities; the support is intended to improve health, reduce the time used for collecting water – particularly for women and girls - raise school enrolment, retention and performance of children and enable beneficiaries to improve their livelihoods. There is consensus on the importance of such impacts but conventional evaluation studies do not usually quantify them. The study further includes an assessment of the sustainability of the programme benefits. A mid-term assessment of sustainability may seem premature. However experience suggests that a number of factors commonly influence the sustainability of rural water supply and sanitation interventions and that it is useful to identify their presence or absence at an early stage of strategy implementation.

[1] The DNA and key PRONASAR donor partners have recommended the adoption of 300 people per water point within 1 km distance providing 20 litres/person/day as the standard for planning.

The methodology for the impact study entails a combination of quantitative and qualitative methods and techniques. Impact is measured by comparing changes in impact variables over time and between locations with and without programme interventions. The main data collection techniques comprise sample based surveys, conducted in 2008 and 2010, water quality tests, field observations and interviews with key informants.

Main findings

1. **The number of new water points has increased substantially between 2008 and 2010 and consequently the number of users per water point has fallen. The One Million Initiative is responsible for the large majority of the increased use of improved water sources.**

The number of new improved water points created between 2008 and 2010 under the One Million Initiative is 994 according to the programme's records. The sample indicates that the percentage of households in the population using improved water sources for drinking water has increased from 16% in 2008 to 28% in 2010. In the sample the increase is from 15% to 42% of which more than two thirds can be attributed to the One Million Initiative. Sample evidence shows that households in locations that got an improved water source under the One Million Initiative are 32 percentage points more likely to use safe water points. Similarly, receiving a CATS intervention makes it 16 percentage points more likely that households switch to using improved water sources.

However the number of improved water sources is still far below the target of one water point per 500 persons. Rough estimates of the water user population indicate that the average number of persons per water point has fallen, especially in the targeted poorer section of the population, where it declined from around 3,750 in 2008 to 1,250 in 2010.

2. **About one third of households in communities with a water point intervention did not switch to an improved source. Use of improved water sources is mainly determined by distance to the improved source.**

31% of the households in villages where an improved water source was introduced continue using unimproved water sources. This is particularly true for interventions early in the programme. The continued use of unimproved sources traditional sources is mainly explained by long distances to the improved water source. Distance to the source clearly has a strong effect on using the improved water source. An increase of one kilometre in the distance to the improved source reduces the probability that a household uses it by 18.3 percentage points. In addition the high number of users, resulting in queuing and long waiting time at the water point, may partly explain continued use of unimproved sources.

There are no indications that other barriers exist, including specific barriers for poorer households. Charging for water has become more common but there are no indications that user charges have acted as a barrier against using improved water sources. In 2010 80% of the improved water sources users were reported to pay for water (as compared to 48% in

2008) and most households (70% in 2008 and 81% in 2010) found user charges reasonable or cheap. A few informants reported that people still get water even if they do not pay, irrespective of whether they are unable or unwilling to pay.

3. The vast majority of households use the same water source for all domestic purposes. The quantity of water consumed from improved water sources is low and even fell between 2008 and 2010.

Water from improved water sources is not only used for drinking: 95% of households reported that they use it for cooking, 91% for washing hands, 89% for washing of kitchen utensils, 84% for bathing and 66% for laundry. About 30% of households reported using water from improved sources for non-domestic purposes, mostly for small animals and construction.

Only 5% of all households and 11% of households that use an improved water source resort to a secondary water source. These are mostly exclusively traditional sources. 10% of these households report using the unsafe secondary source for drinking. Most of the households use these for bathing (96%), washing kitchen utensils (79%), washing hands (35%) and laundry (37%).

In 2010 households used only half of the recommended 20 l/p/d. The survey indicates a mean domestic water use of 10.2 litres per capita per day in 2010, compared to 12.6 litres in 2008, which is a decrease of 2.4 litres, both in intervention and non-intervention areas. Only 14% of the households in the sample consume more than 20 l/p/d. The fall in water consumption is significantly less for households who perceive an improvement in the quality of their drinking water.

4. The recent switch to a new improved water source has led to a substantial increase in water quality at the source and also at the point of use. Improved water sources are however not always safe.

Earlier studies have shown that water quality often deteriorates considerably between the source and the point of use. Nevertheless, in this evaluation it is found that when households switch to a microbiologically uncontaminated water source this increases the probability that the water is also clean at the point of use by 47 percentage points. However, this improvement does not apply to all households in programme villages: some households do not switch to improved water sources when they are available and improved water sources are not always safe. This study finds that as much as 33% of the water samples taken at the points of use in villages where new water sources had been introduced by the One Million Initiative were still microbiologically contaminated.

A disturbing finding is that improved water sources are not always safe: in 2010 19% of the samples from improved sources was contaminated by coliform bacteria. Less surprisingly, of the unprotected sources 97% were unsafe in 2010. Confirming the findings from earlier studies, water quality at the point of use is much lower than at the source.

While households do not appear to report water quality at source accurately they do perceive quality improvement where interventions took place: there is a large and significant improvement in self-reported water quality as a result of switching to an improved water source. On the other hand, households are not well able to judge the quality of water at the source. Since there is evidence that the decision of a household to switch to an improved source depends on the household's assessment of its quality there is a case for disseminating reliable information on water quality.

5. There has been a large increase in the ownership and use of latrines, particularly for households with more than average wealth increase. A large part of this increase can be attributed to an innovative approach to sanitation: CATS. However only a few latrines satisfy the conditions of adequate and safe sanitation.

There has been a large overall increase in the use of latrines. Households whose wealth increased between 2008 and 2010 were more likely (10.5 percentage points) to acquire a latrine, suggesting that costs of latrines plays a role. While some of this increase is autonomous (6.9 percentage points), survey data indicate that The Community Approach to Total Sanitation (CATS) has resulted in a substantial *additional* increase (13.6 percentage points) in the ownership of a private latrine which in turn has led to increased use of latrines. This is a strong and robust result. This positive finding is remarkable in view of the generally disappointing findings in other countries on the effectiveness of sanitation and hygiene awareness programmes.

The question remains whether these latrines satisfy conditions for effectively breaking disease transmission. Mozambique uses specific criteria for adequate and safe sanitation. Adequate sanitation is defined as a latrine with a safe hole (not necessarily a slab), a roof (if it does not have a concrete slab) and a lid over the hole. The concept of safe sanitation further requires the presence of a handwashing facility with soap or ash and that it offers privacy. Only a few latrines meet all the conditions of safe sanitation (2.9% in CATS communities against 3.9% overall) and even fewer qualify for safe sanitation (1.4% in CATS communities against 0.7% overall). Households in CATS communities have a lower share of latrines with a "safe-hole" (45.5% against 53.6% overall). Households in locations with CATS intervention however are more likely to have a handwashing facility (42% against 37% overall) and a latrine with a lid (33% against 29% overall).

6. Cleanliness of latrines has improved and the use of soap or ash instead of water only for handwashing has increased. Also the practice of water treatment has become more common. The changes are most prominent in locations with CATS interventions. No evidence of impact on other hygiene practices was found.

Cleanliness of latrines has improved, especially in locations that received the CATS awareness intervention. In the questionnaire "clean" is defined as absence of faeces or urine. Latrines are generally clean: in 2010 more than 94%, regardless of programme intervention. Handwashing using soap or ash has become more common. The change in using soap or ash is most prominent in the case of handwashing after defecation: in 2010 more than 40% of adults reported to practice this, compared to only around 20% in 2008.

The vast majority of households do not treat water, 86% in both survey years. The data suggest however that CATS interventions prompt more households to treat their water: 20% of households in locations that only received CATS intervention treated their water, against only 2% in 2008.

There has been a general increase in the use of lids on containers for fetching and storing water. This increase is however unrelated to programme interventions. About half of the households use racks for drying cooking utensils, especially in locations with water interventions. Around 85% of households dispose safely of baby excreta. This number has not changed between survey rounds.

7. Prevalence of water related diseases generally declined according to the health indicator used in this study, from 31 to 14%. The sanitation intervention is responsible for 3 percentage points or a sixth of this decline. This is a strong and robust effect. However, the precise quantitative health impact cannot be derived from it since the indicator is very likely to underestimate prevalence of water related diseases.

There has been a general decline in the prevalence of water related diseases in the sample. The analysis demonstrates that a significant part of this decline is due to the CATS interventions. Controlling for other determinants of the change in disease prevalence, this intervention is responsible for a 3 percentage point decline of the disease indicator in the sample.

The health indicator used in deriving this result appears to underestimate the prevalence of water related diseases. This is no reason to question the finding of favourable and sizeable health impact, but it does make it impossible to translate the decline in disease into a reduction of disease burden in terms of disability-adjusted life years (DALYs), as was envisaged in the terms of reference for the study.

8. Enrolment in schools increased modestly, particularly for girls, but this is not related to the interventions under the One Million Initiative, neither at the schools or at the community level. The number and use of latrines in schools increased, in particular of single sex latrines. The practice of handwashing after defecation has become much more common in schools.

From the household and school surveys it does not appear that school enrolment went up more as a result of interventions. Hence, contrary to what one might expect, there is no evidence that water interventions stimulate enrolment of e.g. girls by releasing them from water fetching chores.

The number of latrines per school increased rapidly in sample schools, from around 2 to 3 per school. At the same time the number of single sex latrines increased. By now, all survey schools have separate latrines for boys and girls. Students increasingly use latrines, reflecting better availability of facilities.

The practice of handwashing after defecation has become much more common: in 2010 there were only 12 schools (out of 68) left in which none of the girls and boys wash their hands. In 2008 the number was 57 (boys) and 58 (girls).

9. Good progress has been made towards sustainable benefits. However some weaknesses in policy and institutional arrangements and economic and technical constraints undermine long term sustainability.

It is too soon to say definitively whether the benefits being achieved by the One Million Initiative are sustainable. Overall, good progress towards sustainable results is being made. But a number of weaknesses will have to be resolved and major outstanding challenges overcome, if true long term sustainable benefits are to be realised.

A broadly appropriate national policy framework and institutions for rural water and sanitation are in place. This framework has been conducive to good progress of One Million Initiative's outcomes. The percentage of functioning water points in the programme area has increased substantially, from 54% to 82%. The percentage of improved water points managed by a committee also increased substantially, from 64% at 42 improved water sources in 2008 to 77% at 86 improved water sources in 2010. 68% of the committees were established in 2008 or later. Committees typically have between five and ten members, with a roughly even gender balance (modal number of men was 3 and women 5). 72% of these committees reported to have installed a maintenance group. Payment of a small amount for use of the improved water points, usually per month, is common. According to the 2010 field survey this was done at 79% of the sample improved water points where only water supply was improved and in 92% of the points where also sanitation interventions had been undertaken.

Government and NGOs do not yet have the capacity to provide and sustain the required services in the long term. The government has relied heavily on NGOs for programme implementation. NGO capacity cannot be taken for granted when it is not clear if sufficient funds will be available in the future for using it. For instance it is not clear whether the community based activists currently employed by the NGOs working for the One Million Initiative programme will continue to be paid after the end of the programme.

The private sector cannot play its important role in providing repair services because of unattractive market conditions. Pump repairs can take a long time: in 2010, it took more than three months to repair the last breakdown at 23 (52%) of 44 water points that needed repairs.

Sustainable management by communities is not yet assured, despite promising progress to date. One key issue is that knowledge, skills and procedures are not yet deeply rooted. Administrative procedures introduced by the programme are often inconsistent or only partially implemented. Institutional accountability mechanisms are not yet strong. Sustainable management of water supply and sanitation infrastructure at schools is easier to assure. School management structures are already in place and, with a bit of training and

support, should be able to extend their management functions to the effective maintenance of the new facilities. The sustainability of rural water and sanitation depends at least as much on institutional maintenance as it does on technical maintenance.

The policy assumption that communities will be able to meet costs of major repairs and replacement of water infrastructure from the water revenues is not realistic in the short to medium term. Environmental problems are poorly understood, especially the potential impact of climate change.

The sustainability of water supply services and the impact of benefits is also negatively affected by the current high average number of users per water point.

The government's monitoring system for community-based safe water and sanitation results and sustainability is not yet sufficiently focused. The programme's systems are being used to keep track of community-based services. However these do not capture social, institutional and behavioural aspects that determine whether innovations will be sustainable. Furthermore, a focused and effective monitoring system must also cover water quality. Arrangements for this have not yet been developed, although the matter is receiving attention.

Issues

The findings suggest a number of issues that will require further attention, notably:

1. Contamination of drinking water: apart from inadequate monitoring arrangements, adequate measures to ensure water safety at source and at point of use are not in place. Access to safe water through public facilities goes beyond water supply infrastructure and requires explicit attention for safe transport and storage of water and water treatment.

2. Limited perspectives for full rural water users' responsibility for the depreciation cost of their water infrastructure, requiring clarification and restatement of policy.

3. Community institution-building: the youth and inexperience of most management committees (two thirds established in 2008 or later) are one reason why the sustainability of this capacity is still far from assured. Capacity gaps include skills of field staff and user groups that go beyond implementation of standard approaches into appropriate discretionary adjustments to specific local circumstances.

4. Lack of provisions for sustained services of community-based activists playing a key role in building and sustaining community structures.

5. Current lack of capacity to take into account environmental aspects.

6. Lack of adequate provisions for institutional maintenance for rural water and sanitation - one possibility under discussion is that PRONASAR could fund an on-going role for the NGOs that currently provide this vital service.

7. Current lack of an economically viable linkage of private sector supply with water user demand for technical and institutional services.

8. On-going challenges regarding the maintenance of latrines – which should be facilitated by the widespread use of local construction and materials – and of CLTS-induced behaviour: there is reportedly little international evidence yet on the latter.

9. The need for continued strengthening of local and national monitoring arrangements, linked to management arrangements, to ensure timely availability of reliable data on installation of water supply facilities and their functioning, on drinking water quality, sanitation facilities and hygiene practices and on institutional factors that may undermine services provided, with a view to timely address bottlenecks.

1

Background and methodology

1.1 Purpose and focus of the impact evaluation

In 2008 the Government of Mozambique, UNICEF and the Government of the Netherlands agreed to an impact assessment at mid-term and end of the Government of Mozambique/ UNICEF Water supply, Sanitation and Hygiene programme - the One Million Initiative - Mozambique. A substantial part of Netherlands development funding for water supply and sanitation goes to UNICEF programmes. The One Million Initiative is the largest Netherlands supported programme. Programme implementation started in September 2006 and will end in December 2013. The current report is on the mid-term impact assessment.

The impact evaluation is jointly executed by the Policy and Operations Evaluation Department (IOB) of the Netherlands Ministry of Foreign Affairs, Ms. R.Tesselaar and the central Evaluation Department of UNICEF, Mr. S. Bickel, with major support of the water supply and sanitation team of the UNICEF Mozambique Office and the Government of Mozambique water sector authorities. Technical services for evaluation design, data collection and analysis have been provided by Professors J.W. Gunning and C. Elbers of the Amsterdam Institute for International Development, a research team of WE Consultant based in Maputo, and freelance consultants Dr. S. Turner and Mr. B. Matabire.

Within the framework of a partnership between the Government of Netherlands, UNICEF and the Government of Mozambique, which aims at accelerating the achievement of the Millennium Development Goals (MDG) with respect to the access to drinking water and adequate sanitation for families and school communities, the Water Supply, Sanitation and Hygiene Programme– the One Million Initiative – is being implemented in 18 districts of the provinces Manica (Gondola, Guro, Machaze, Manica, Mossurize and Sussundenga), Sofala (Chemba, Dondo, Gorongosa, Maríngue, Muanza and Nhamatanda) and Tete (Angónia, Changara, Chifunde, Tsangano, Marávia and Zumbo). As a result of this partnership it is expected that

- One million people in the rural areas use safe drinking water, through the construction of new sources of water supply;
- 200,000 people use safe drinking water, through the rehabilitation of their sources of water supply;
- One million people use adequate sanitation facilities;
- 1.2 million people adopt appropriate hygienic practices;
- 400 primary schools (with a total of 140,000 pupils) use infrastructures of drinking water, sanitation and hygiene;
- 18 districts and 3 provinces have strengthened technical and management capacities for the planning, coordination and implementation of programmes for water supply, sanitation and hygiene education.

The total budget for the programme is EUR 32.64 mln, of which 65% is provided by the government of the Netherlands, 19% by UNICEF, 13% by the Government of Mozambique and 3% by beneficiary contributions. The programme is by far the largest in the provinces and is spearheading rural water supply policy implementation.

The focus of the assessment is on the impact of interventions on the welfare of the final beneficiaries. The ultimate purpose of the support provided to water supply, sanitation and hygiene goes beyond coverage: the support is intended to improve health, reduce the time used for collecting water – particularly for women and girls –, raise school enrolment, retention and performance of children and enable communities to improve their livelihoods. There is consensus on the importance of such ultimate impacts on human welfare but conventional evaluation studies do not usually quantify them. Quantification is a key characteristic of the impact study. The study further includes an assessment of sustainability of the programme benefits. Sustainability is defined as the (probability of) continuation of benefits after major development assistance has been completed.[2] The assessment addresses relevant institutional factors, linked as they are to society's governance and politics, as well as technical, economic and environmental determinants of sustainability.

For the Government of Mozambique and the UNICEF Mozambique Office the impact assessment is expected to provide information that will help to steer the programme and inform policy and policy implementation. For the UNICEF central Evaluation Office the study is expected to provide an opportunity for global learning on impact evaluation of water supply and sanitation programmes. For the Policy and Operations Evaluation Department (IOB) of the Netherlands Ministry of Foreign Affairs the impact assessment is one in a series of impact evaluations of Netherlands supported programmes for water supply and sanitation facilities. The evaluations will provide information for a policy evaluation planned to be completed in 2011.

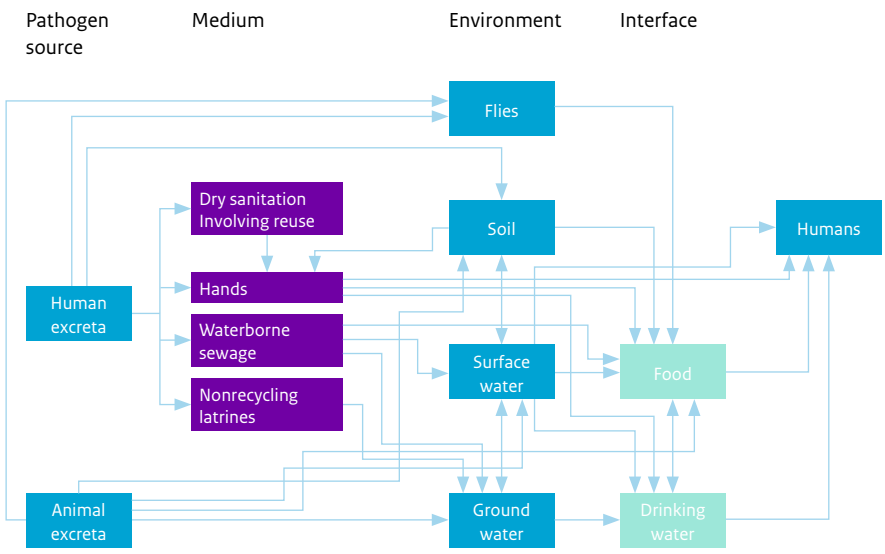
Theory of change underlying water supply and sanitation programmes

Recent estimates of the World Health Organisation (WHO) ascribe about 10% of the global disease burden to water borne diseases; and in a low income developing country like Mozambique the situation is obviously worse than average. 16.2% of all deaths and 17.2% of the disease burden (measured in DALYs – Disability Adjusted Life Years) are estimated to be due to water borne diseases in Mozambique, the problem being more pronounced for children (Prüss-Üstün *et al.*, 2008).

Transmission channels of water borne disease and, accordingly, the way to achieve improvements are far from straightforward as Figure 1 illustrates. The consumption of safe water, leading to a reduction of water induced illness (impact), depends on numerous influencing factors such as sanitation and hygiene behaviour and knowledge. Improving the latter could be the objective of a hygiene intervention, implemented separately or in co-ordination with the water intervention.

[2] Source: OECD/DAC terminology for evaluation and result based management.

Figure 1 *Transmission pathways of faecal-oral diseases*



Source: Fewtrell and Colford, 2004, p. 3

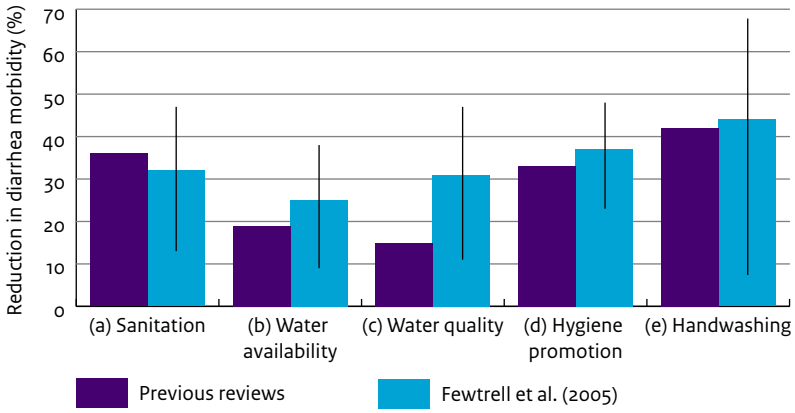
The assumed causal chain from interventions to health impacts can be summarised as follows: provision of water infrastructure facilitates the increased use of safe drinking water and thus helps to reduce the intake of disease-inducing pathogens. The intake is further reduced by the removal and safe deposit of human faeces (rich in pathogens) by means of an adequate sanitation infrastructure (latrines, water closets) and proper hygiene behaviour, which improves water quality on the one hand and reduces direct contact with pathogens on the other hand. It is therefore important that hygiene and sanitation practices are included in the impact analysis. Time savings due to closer proximity to water points, better availability in terms of quantity and possibly reduced queuing time are another impact channel. The reduction of health threats further contributes to time savings as less time needs to be spent on being ill or caring for sick family members.

Existing empirical evidence

Evidence on the effectiveness of water supply and sanitation programmes has become more numerous during the last few years although the knowledge is still far from complete. The probably most thoroughly researched area is the effect of WSS interventions on health, especially on reducing diarrhoea morbidity. Results of existing studies have been summarised in several meta studies (e.g. Fewtrell *et al.*, 2005; Waddington and Snilstveit, 2009). This literature concludes that there is little or even no health impact of village level water provision. Waddington and Snilstveit (2009) conclude that water supply interventions "appear ineffective" while water quality interventions (e.g. chlorination, filtering, boiling)

significantly reduce child diarrhoea morbidity. Fewtrell *et al*. (2005) come to a slightly different and positive conclusion. Their evidence is summarised in Figure 2 and illustrates that even though water supply (column b) has the lowest effect on health in comparison to sanitation infrastructure, hygiene promotion and point-of-use water quality improvements, a new water point should still reduce diarrhoea by about 20%. Figure 2 does also show that the same intervention might have different effects depending on the context, as the variation in the effect documented in different studies illustrates. (The variation is visualised by the vertical lines[3] in Figure 3, while bars show study averages in diarrhoea reduction). Interestingly, Fewtrell *et al* (2005) as well as Waddington and Snilstveit (2009), find multiple interventions (consisting of combined water, sanitation and hygiene measures) not to be any more effective than interventions with a single focus. Other studies (e.g. Esrey, 1996), however, stress the importance of adding a hygiene promotion component to water supply and sanitation measures in order to increase the impact of water interventions.

Figure 2 *Reduction of diarrhoea as a result of water supply, sanitation and hygiene improvement*



Source: Fewtrell et al., 2005

It becomes apparent that although evidence is quite numerous and meta-studies on health effects have been conducted, knowledge is far from firmly consolidated. Furthermore, context specific influences seem to play a major role. Knowledge gaps on other impacts attributed to water supply, sanitation and hygiene interventions are even larger. Rather firm evidence does exist on time savings induced by improved water sources in rural areas. However, very little is known on how these time savings translate into other activities and whether the desired improvement in livelihoods of the beneficiaries is actually achieved. Evidence on presumed time saving effects induced by sanitation and hygiene interventions is even scarcer. If economic benefits triggered by WSS interventions are estimated, it is usually done by approximation, e.g. by multiplying the saved number of sick days or induced time savings by a wage rate which seems to adequately reflect the context (Hutton and Haller, 2004).

[3] 95% Confidence Intervals

Adding to the open questions on the impacts of WSS interventions, some researchers (Zwane and Kremer, 2007; Waddington and Snilstveit 2009) have criticised existing studies for often having inadequate research designs (without proper control and treatment groups). More important, large-sample studies of governmental programmes with experimental or quasi-experimental evaluation design on the health impact of village level water provision are scarce.

1.2 Key evaluation questions

The key questions addressed by the impact assessment are the following:

Programme and context

1. What have been key problems addressed by the UNICEF Water Supply, Sanitation and Hygiene programme in Mozambique?
2. What has been the approach and specific interventions to address the problems?
3. What have been the achieved main outputs as compared to targets (number of new and rehabilitated water points, number of latrines, infrastructure at primary schools, community level water and other relevant committees, government, NGOs and private sector support services)?
4. What have been the costs for key cost units and cost trends?
5. How did the institutional strategy for providing and sustaining works and services evolve?
6. Have roles and responsibilities been clearly defined? Are these adequately understood and fulfilled by beneficiaries and other stakeholders?
7. How did this strategy affect programme outputs?

Effects

Community water supply, sanitation and hygiene component

8. What has been the average number of users per improved water point in the sample?
9. What has been the effect on the percentage of the population that use an improved water source?
10. Have there been barriers to the access to the improved water source? If so, which proportion of households in the sample communities do not have access and why?
11. Is the improved water point the only water source for domestic use? If not, which other (improved and unimproved) sources are used, when and by how much are these used and for what purposes?
12. What has been the effect on the microbiological and chemical quality of drinking water (at source and point of use)?
13. What has been the effect on the amount of water used per day per person for domestic purposes (total, from improved water source)?
14. What has been effect on the access and use of improved sanitary facilities (for men, women and children)?

15. What has been the change in relevant hygiene awareness and practices (such as cleanliness of latrine, handwashing with soap or substitute at critical times, safe water storage, use of rack for cooking utensils, safe handling of baby excreta)?
16. What has been the effect of the interventions on the health of the target population (in terms of DALYs reduction[4])?
17. What has been the effect on time use for collection of water, and for which household members?
18. In what way have time savings been used (for domestic work, field work, income earning, schooling, etc.)? Who are the primary beneficiaries?
19. Is the water from the improved water source used for other purposes, besides domestic purposes? If so, for which purposes and by whom?

School Component

20. What has been the effect on the number and percentage of schools with a functioning safe water source in the school yard or within 200 meters from the school yard?
21. What has been the effect on the change in the number and percentage of schools with latrines (separated for girls, boys and school personnel)?
22. Do these schools have an operation and maintenance system in place?
23. What has been the effect on the use of latrines for girls, boys, and school personnel?
24. What has been the effect on handwashing practices for girls, boys, and school personnel (before meals and after going to the toilet)?
25. What has been the effect of programme interventions on school enrolment and outcomes (for girls and boys)?

Sustainability of benefits

26. Are an appropriate national policy framework and institutions in place?
27. Does the government at provincial and district level, NGOs and private sector involved have the capacity to provide the required services for sustaining services in the long term?
28. Is sustainable management of the facilities by beneficiary communities and schools ensured?
29. Are there issues that affect sustainability of benefits, not captured under question 27 and 28? Have these been addressed and with what result?
30. Is the Government monitoring system for community based safe water and sanitation results (including quality of services) and sustainability focused and is information used to keep track of community based services and address bottlenecks in a structural way?

The questions on sustainability slightly deviate from the questions taken up in the overall ToR for the impact assessment as per the agreed ToR for the sustainability assessment mission.

[4] DALYs stand for Disability-Adjusted Life Years and is mostly used in international research as measure for disease burden. A DALY stands for one year of life that a person loses as a result of less good health.

1.3 Methodology

Programme and context description

Questions 1-7 have been addressed largely on the basis of review of programme documentation – in particular policy and programme design documents and progress reports, as well as the field study described below.

Impact assessment

The impact assessment addresses questions 8-25. Interventions under the One Million initiative can broadly be divided into five areas: (1) providing safe water points; (2) increasing the number of latrines; (3) promoting improved hygiene awareness and practices; (4) providing safe water and latrines as well as hygiene education in schools; (5) capacity building. Questions 8 up to 25 on outcome and impact relate to the interventions 1 to 4. Questions 26 to 30 relating to the fifth intervention are less suitable for statistical impact evaluation and have been taken up in the section on sustainability assessment.

The objective of the impact assessment is to estimate the impact of a large scale intervention on use of WASH services and changes in hygienic practices and subsequently on time savings, health and socio-economic indicators. With respect to the impact on health and socio-economic indicators the focus has been on diarrhoea and cholera[5] and the use of extra time and/or water on school enrolment and outcomes.

The intervention is large scale in the sense that the individuals affected by the programme are a big proportion of the population: as high as 50% over the course of the programme. The actual 'levels' or 'intensities' of the four intervention areas mentioned above will differ between sampled communities, making it possible to compare outcomes for different combinations of interventions at different stages.

The mid-term impact assessment covered the 80 villages and schools (40 randomly selected and 40 treatment villages and schools) assessed during the baseline survey. A full intervention history for each of these sampling units has been made available to assist in the design of the survey.

The sample and data collection

In order to obtain more direct measurements of the impact of the One Million Initiative, a sample was drawn of 80 communities from 9 of the 18 districts covered by the Initiative. Details about the sampling procedure can be found in Chapter 4. Half of the sample, or 40 communities, is representative of the general population of the 9 sample districts. The other 40 communities were drawn from a poorer target section of the population. When the sample was drawn this part of the population was expected to get relatively more new

5 Prevalence of cholera in the sample was too low to analyse in a systematic way.

safe water points and be more intensively affected by the One Million Initiative. Thus, the complete sample of 80 communities has intentionally oversampled 'treatment communities' in order to get a better picture of activities under the One Million Initiative and achieve greater statistical precision when comparing (high intensity) treatment to no treatment (or low intensity treatment) communities.

For each of the sample communities a number of surveys have been carried out: a household sample was conducted among 20 households selected (by systematic sampling) from a randomly chosen contiguous group of approximately 100 households (or 500 persons). This survey covers, besides general household characteristics, health and water and sanitation practices. In addition, a focus group discussion and water point survey was conducted in the neighbourhood where the 20 sample households live. Water samples were taken at a selection of households (10% of sample) and at the water sources used by these households to test for microbiological contamination. Also, information from health posts close to the sampled location has been collected that can be linked to the various samples.[6] This information includes the number of recorded cases of particular diseases and disease-specific mortality data.

A separate survey has been conducted among 80 schools from the 2 programme districts participating in the Child-Friendly Schools for Africa Initiative (CFS), see page 54 in Chapter 3. These districts are not covered by the other surveys. All sample households, schools and communities have been visited twice, in 2008 and 2010, and will be visited again in 2013.

Sustainability assessment

Questions 26-30 have been addressed on the basis of:

- review of documentation, including annual sustainability assessment reports commissioned by UNICEF;
- interviews with key informants at community, district, provincial and national levels;
- data from the field surveys.

A mid-term assessment of sustainability may seem premature. Definite conclusions on sustainability of the arrangements can only be reached in the long term on the basis of empirical observations about whether the intended beneficial impacts continue to be enjoyed. However experience suggests that a number of factors commonly influence sustainability of rural water supply and sanitation interventions and that it is useful to identify their presence or absence at an early stage of strategy implementation. This chapter offers observations indicating trends towards sustainability.

[6] Use of this information was not successful, probably because the catchment area of a health post is too large to identify the effect of the interventions.

The following sets of factors have been identified. First institutional factors, linked as they are to the fundamental quality of society's governance and politics, are often most influential and complex determinants of sustainability of rural water supply, sanitation and hygiene promotion interventions and beneficial impact. The assessment therefore gives them special attention. The assessment focuses on local institutions, as this is the level of governance most critical to the sustainability of rural water supply and sanitation arrangements. However, it has also addressed the influence of changing structures and roles at provincial and national level on sustainability of benefits.

Linked to institutional factors is a set of technical factors such as durability of water supply infrastructure and operation and maintenance. A third set of factors are economic factors: the question what resources is society able and willing to invest in the installation, operation, maintenance and renewal of water supply, sanitation and hygiene promotion arrangements and how are costs and benefits of these investments distributed across society and over time. Fourth, environmental factors play various fundamental roles in determining sustainability (for example influencing availability of groundwater). The fifth set of factors are behavioural factors explaining uptake of water, sanitation and hygiene messages, such as the degree to which people perceive the messages to be true, observe benefits and perceive higher costs or labour to be a good trade-off for the benefits.

1.4 Structure of the report

The report continues in chapter 2 with a description of the relevant context. Chapter 3 describes the One Million Initiative 2006-2013, its approach and activities, institutional strategy and outputs to date. Chapter 4 provides the mid-term quantitative impact analysis. Chapter 5 continues with the assessment of sustainability of programme interventions and beneficial impact.

2

Problem and context

2.1 Demography and society

The population of Mozambique was 20.6 mln in 2007, with 69% classified as rural (GOM, 2010a). The average population density was 26 people per square kilometre. The density for 2010, at 29 per square kilometre, ranks Mozambique joint 37th (with the Democratic Republic of Congo) out of 54 African states and territories (UN Data, 2010). Demographic data are shown below for the three provinces where the One Million Initiative works.

Table 1 Manica, Sofala and Tete provinces: demographic data

Province	Population, 2007	Population/km², 2007	% rural population, 2007	Annual population growth rate, 2007 (%)
Manica	1,438,476	23	75	3.8
Sofala	1,671,864	25	62	2.4
Tete	1,801,528	21	86	4.2

Source: GOM, 2010a

It can be seen that all three provinces are predominantly rural and have population densities below the national average. The demography of Sofala province is influenced by the presence of the city of Beira. But this province showed the slowest rate of population growth of the three. Tete showed the highest, due to strong migration (mostly by younger men) to its expanding economy. Most of Tete, like most of the other two provinces, is made up of purely rural communities. The size of 67 of the communities surveyed in nine districts across the three provinces for the One Million programme's baseline study in 2008 ranged from an average of 632 in Guro district (Manica) to 3,338 in Gorongosa district (Sofala) (WE Consult, 2009: 21). Variance in rural settlement distribution and size depends largely on the productivity of the natural environment, although ethnic and cultural factors also play a role. In all areas, however, there is a degree of nucleation that makes the provision and use of service points like boreholes and wells a feasible strategy. At the same time, the distance that community members may have to walk to a water point within their settlement may vary significantly, and the population of some rural communities is large enough to require two or more water points if minimum supply quantities are to be assured.

The people of the three provinces have a common historical background – centuries of colonial domination and 35 often turbulent years as citizens of independent Mozambique – but belong to many different ethnic groups. Community institutions function largely in the many local languages, with only a minority of rural people also fluent in the official language of Portuguese. People's political, military and social experience varied during the liberation struggle and subsequent civil war. Many in northern Tete province, for example, spent years in refugee camps in Malawi and retain strong links with that country. Various broadly standard social features prevail across the One Million programme area, however. These include the resurgent role of and respect for traditional authorities following the more favourable shift in government policy towards them; the gender distribution of roles in rural livelihoods, with a prominent place for women in water supply and sanitation issues; and a general willingness to pursue group action and responsibility in the develop-

The province of Tete

ment and management of local infrastructure. Despite significant progress in the extension of administrative services across the ten provinces and 128 districts of Mozambique, rural society must still fend largely for itself in the day to day conduct of its affairs.

2.2 Natural environment

The natural environment in the three provinces of the One Million Initiative ranges from the coastal lowlands of Sofala to the cooler uplands where Tete province borders on Malawi at altitudes of more than 1,500 metres above sea level. The agricultural potential of these provinces varies with soils, topography and rainfall, which ranges from under 500 millimeter per year in northern Manica province to over 1,000 millimeter per year in some areas near the Sofala coast and in the highlands of Tete. Droughts became more frequent in the second half of the 20th century, but central and southern Mozambique are also notoriously vulnerable to cyclones and flooding. Across the country, average rainfall is expected to decrease by 5-10% during this century as a result of climate change (European Commission, 2006: 17-18). The seasonal rainfall pattern influences fluctuations in disease risk arising from open defecation, as well as the availability of water for collection from rivers and pools.

Groundwater resources are widely available in these three provinces. Their exploitation through boreholes equipped with hand pumps forms the technical backbone of rural water supply strategy. The depth of suitable aquifers varies. Negative boreholes (where drilling finds saline, little or no water) are common, and in some areas (notably Machaze district in Manica province), adequate water is often available only at depths not suitable for the hand pumps used in most of the programme. Angonia and Changara (Tete), Guro and Mossurize (Manica) and Maringue (Sofala) are other districts with common geohydrological and/or salinity problems. Due largely to salinity, only five out of 30 boreholes drilled in Chemba district (Sofala) in 2009 were positive. Investigations to date suggest that arsenic levels in

groundwater are not a significant concern in these provinces. Current and anticipated levels of groundwater extraction with hand pumps for domestic use are not believed to pose any threat to groundwater availability, although the rates and mechanisms of aquifer recharge in these provinces are not yet well understood. The development of commercial irrigated agriculture and the rapid expansion of mining in Tete province could influence groundwater availability for domestic use, if those activities themselves exploit aquifers rather than surface water. These are not immediate threats, however.

2.3 Economy and poverty

The rural economy of Manica, Sofala and Tete provinces is dominated by subsistence agriculture. 86% of households covered by the 2008 baseline survey reported agriculture as their most important economic activity, with 6% reporting permanent paid employment as most important. Animal husbandry was the most commonly mentioned second or third economic activity (WE Consult, 2009: 33). Most of the population lives in poverty. Using a wealth index based on possession of a bicycle, a radio or a watch, the baseline survey found that 56% of female headed households fell into the poorest group, as opposed to 17% of households headed by men. Little of the commercial farming established by colonial settlers survives, although the commercial agriculture sector is now expanding again. There is significant economic growth and infrastructural development along the 'Beira corridor' between that port and the Zimbabwe border. The strongest economic activity is in the rapidly expanding coal mining sector in southern Tete province, which is causing rapid commercial growth in Tete city and attracting labour from the rural hinterland.

Mozambique's Human Development Index (HDI) dipped from an already low level during the first half of the 1980s, and has risen steadily since. At 0.284 in 2010, however, it remained below the averages (0.389) for sub-Saharan Africa and for all 'low human development' countries (0.393), and ranked 165 in the world (the Democratic Republic of Congo was in 168th place). Inequality is also a significant factor: on a different HDI calculation that takes inequality into account, Mozambique scored only 0.155 in 2010. On a Multidimensional Poverty Index that takes health, education and standard of living into account, Mozambique's 2010 score was 0.481, with a multidimensional poverty headcount higher than that for income poverty – indicating that some people above the income poverty line still suffer one or more of these other deprivations (UNDP, nd).

There are many ways to measure poverty. They all show the continuing gravity of the problem in Mozambique, but they also show some improvement since the end of the civil war. The data below show an overall stagnation in the poverty headcount between 2002-03 and 2008-09, as well as significant negative and positive swings. Taken as a whole, the central zone of Mozambique, in which the One Million Initiative provinces lie, experienced an increase of 14.2% in the poverty headcount during that period. Sofala province experienced a significant rise in its poverty headcount. There was a smaller increase in Manica, while the poverty headcount fell in Tete. Government analysis warns that "undue emphasis should not be placed on the precision of poverty estimates at the provincial level…

Nevertheless, the broad spatial pattern of changes in consumption poverty (i.e., improvements in the North and South, worsening in the Centre) is also consistently confirmed by other data sources and analytical methods". It points to very slow rises in agricultural productivity, weather shocks that reduced 2008 harvests, especially in the Central provinces, and sharp increases in fuel costs (GOM, 2010b: xii, xiv).

Table 2 Poverty headcount, 1996-97, 2002-03 and 2008-09

	1996-97 %	2002-03 %	2008-09 %
National	69.4	54.1	54.7
Urban	62.0	51.5	49.6
Rural	71.3	55.3	56.9
Manica	62.6	43.6	55.1
Sofala	87.9	36.1	58.0
Tete	82.3	59.8	42.0

Source: GOM, 2010b: 26

2.4 Health and nutrition

The interrelated burdens of poor health and inadequate nutrition are key dimensions of poverty, as noted above. Mozambique's second Poverty Reduction Strategy, PARPA II, noted that although there had been a favourable trend in indicators of poor health, they were still high (GOM, 2006: 12). Rural people in Mozambique still carry a heavy burden of disease, which is linked to the nutritional status of their children. Rates of HIV infection are high; malaria is a widespread killer; cholera outbreaks are common; diarrhoea is a commonplace for the rural and urban poor.

With particular reference to child mortality and nutrition as poverty indicators, the table below shows selected data for 1997 and 2003.

Table 3 Selected health and nutrition indicators, 1997 and 2003

	Infant mortality, per 1,000 live births		Under 5 mortality, per 1,000 live births		Stunting, 2003 %	Wasting, 2003 %
	1997	2003	1997	2003		
National	147	124	219	178	41.0	4.0
Urban	101	95	150	143	29.2	3.1
Rural	160	135	237	192	45.7	4.3
Manica	91	128	159	184	39.0	2.8
Sofala	173	149	242	206	42.3	7.6
Tete	160	125	283	206	45.6	1.6

Source: Fox et al., 2005: 12

From the 2008 Multiple Indicator Cluster survey, the following data point to some continuing improvement with regard to mortality among infants and children under five, but a deterioration with regard to stunting and wasting.

Table 4 Selected health and nutrition indicators, 2008

	Infant mortality, per 1,000 live births, over 10 years prior to survey	Under 5 mortality, per 1,000 live births, over 10 years prior to survey	% of children who had diarrhoea in the last 2 weeks	Underweight (below -2 SD from median weight for age) %	Stunting (below –2 SD from median height for age) %	Wasting (below -2 SD from median weight for height) %
National	105	154	17.6	17.5	43.7	4.2
Urban	93	135	18.4	12.9	34.8	3.0
Rural	110	162	17.2	19.4	47.2	4.7
Manica	94	154	16.0	19.2	48.3	3.7
Sofala	76	130	15.8	15.5	40.5	3.2
Tete	108	174	18.0	18.5	48.0	2.6

Source: GOM, 2009a: np

The World Health Organisation reported that diarrhoeal disease caused 8% of deaths in Mozambique in 2002 (WHO, 2006). Measuring the incidence of diarrhoea is difficult, because of recall and reporting inconsistencies. The 2008 baseline survey for the One Million Initiative was told that more than 90% of members of sampled households had not been sick with diarrhoea or other waterborne diseases over the previous six months – a period which coincided with the dry season, when these illnesses are much less common than in the wet season (WE Consult, 2009: 31).[7] Cholera is not a major killer, but periodic outbreaks, often associated with floods like those of 2008, do cause significant suffering in these provinces. Malaria, on the other hand, is a constant burden on the quality of life and on economic productivity: it caused 9% of all deaths in 2002 (WHO, 2006).

Table 5 Percentage of persons aged 15-49 testing HIV positive, Manica, Sofala and Tete, 2000 - 2007

		2000	2001	2002	2003	2004	2006	2007
Manica	ANC: women	17.7	12.4	22.7		17.5		16.0
	VCT: women and men				19.3	17.3		
Sofala	ANC: women	31.2	24.4	28.0		29.1		23.0
	VCT: women and men				28.7	24.8		
Tete	ANC: women	20.4	15.9	12.8		16.6		13.0
	VCT: women and men				26.1	24.2		

Source: GOM, 2009b: 70, 72, 74

[7] Since the survey was held in the dry season this report uses six months recall data on water related diseases. This is unfortunate, and deviates from current scientific practice, where e.g. for diarrhoea a two week recall period is the standard. See also the discussion of Evaluation Question 16 in Chapter 4.

Nationwide, 12.5% of Mozambicans aged 15-49 were estimated to be HIV positive in 2007 (CDC, 2010; UNAIDS and WHO, 2008: 3). HIV prevalence data must be treated with caution at provincial level, as they are based on a limited number of sentinel sites and incomplete time series. However, those shown in Table 5 indicate the severity of the pandemic. As in other southern African countries, HIV and AIDS are a major constraint on the economy and on institutions.

2.5 Water and sanitation policy and institutional context

Mozambique's recent strategy for reducing poverty has emphasised the roles of enhanced water supply and sanitation and of effective water resource management. PARPA II (2006-2009) identified these as priority interventions. Improving water and sanitation is seen as a key strategy for strengthening human capital. Its objective was to achieve 55% coverage of the rural population with safe water supplies by 2009, and 70% by 2015. For rural sanitation, the targets were 40% by 2009 and 50% by 2015 (GOM, 2006: 84-85, 112). These targets have been maintained and elaborated in PARPA III, which covers the period 2010-2014.

The continuing evolution of water and sanitation policy in Mozambique can be traced back to the national Water Law that was enacted in 1991. This affirmed all inland water resources as the property of the state, set out a river basin approach to water resource management, and established a National Water Council, which meets infrequently to discuss major shifts in policy. It assigned overall responsibility for water management to the Ministry of Public Works and Housing, where it remains (in the Ministry's National Water Directorate, DNA). The law also established the principles of social, economic and environmental appraisal of proposed developments in the sector.

Water sector reform took a major step forward with the approval of the National Water Policy in 1995. The main principles of this policy, maintained in the revision of 2007, are:

- decentralised, autonomous and financially self-sustaining provision of water supply and sanitation services;
- a greater role for the private sector;
- integrated water resources management taking environmental impacts into account;
- recognition of water as an economic as well as a social good;
- more beneficiary participation; and
- a greater focus on capacity building.

In short, the National Water Policy aims at a withdrawal of central government and its ministries and institutions from operational service provision…
(Van Woersem *et al.*, 2007: 23)

Privatisation has been a marked feature of the development of Mozambique's urban water supply. As one external analysis put it in 2006, "Mozambique reformed its water sector largely by the book" (Gökgür and Jones, 2006: 2). The Water Supply Investment and Asset

Holding Fund (FIPAG) was established as an autonomous public body in 1999, and a Council for the Regulation of Water Supply (CRA) was set up in 2000 with responsibility for "the regulation and monitoring of the water supply operations in all urban areas of Mozambique with a view to balance and conciliate the interests of the water consumers with those of the operators and of FIPAG... [these] new institutions are functioning well and the coverage of the major towns is gradually increasing" (van Woersem *et al.*, 2007: 22-23). However, the early years of privatised operation of urban water utilities were turbulent and, although arguably increasing the availability of potable water to consumers, led to major losses for the operators "due primarily to social pricing, but also to excess labour, the [catastrophic] flood [of 2000] and delayed investment" (Gökgür and Jones, 2006: 2). More recently, the consensus is that the role of the private sector in urban water supply is developing successfully.

Urban areas under the auspices of FIPAG and the CRA are identified through a Delegated Management Framework, through which public-private partnerships are established for water utilities. All other water supplies, urban and rural, are the responsibility of the Provincial Directorates for Public Works and Housing (DPOPH), under the policy and strategic guidance of the DNA. For rural water supply, the key policy principles are:

- highest priority for the satisfaction of basic human needs with regard to water, taking into account the circumstances of the poor;
- provision of an average of 20 litres per person per day from wells or boreholes with hand pumps;
- a planning standard of 500 people (100 households) per water point, which a PRONASAR meeting in November 2010 recommended should be revised to 300 people, with actual coverage based on enumerated populations (PRONASAR, 2010: 1-2);
- users should not have to walk for more than 30 minutes to the water point;
- the price of water should reflect its economic value, "thus trying to cover the costs of operation, maintenance, repair and replacement of equipment";
- government is responsible for investments;
- government should refrain from direct service provision, but be responsible for regulation, facilitation and priority setting;
- institutional capacity building is a priority, with emphasis on district and community levels;
- communities should participate in all phases of the water project cycle, through local democratic institutions;
- direct service provision, e.g. for construction and project supervision, should be carried out by the private sector.

(GOM, 2001: 7-8)

The demand responsive approach at the heart of rural water policy requires communities to make an initial contribution towards the installation of a water point (usually between 2% and 10% of construction cost, up to MT 2,500 (EUR 56)). This does not always happen in practice: the 2010 survey undertaken for this study found that initial payments had been made for 11 (15%) out of 71 water points. Policy also expects users to take full responsibility

for the subsequent operation, maintenance and ultimate replacement of the facility. Under revised national funding arrangements that began in 2008, water and sanitation sector funding is channelled directly to the DPOPH at provincial level and to the district authorities, which, through their District Services for Planning and Infrastructure (SDPI) are taking increasing responsibility for direct support to communities. Under the One Million Initiative, however, all contracts for rural water supply construction and supervision are issued by the provincial DPOPH (although payments are made directly by UNICEF). Municipalities and district administrations are responsible for piped water systems in the smaller urban centres, although the operation of these systems is being contracted to private operators.

The current process of decentralisation is rooted in the adoption of the 1990 Constitution (Massuanganhe, 2005: 13). This provided for the development of local authorities and for local government elections. Decree 15 of 2000 gave a stronger role to traditional leaders and to recognised community authorities. The main legislation governing decentralisation is the 2003 Law of Local Organs of the State (LOLE), which establishes the framework for local government and development functions at provincial and district levels. Under the planning and budgeting systems that are emerging within this framework, districts draw up annual budget proposals that are passed upwards for review through the provincial level to the central Ministry of State Administration and Ministry of Finance. As in many countries, the budget allocations that are ultimately approved are usually lower than the original district requests. Districts employ staff to work in various sectors, including water and sanitation, although again there are budget constraints in this regard. SDPI liaison with communities is supported by District Consultative Councils, which have a monitoring and supervision role and can help to develop and apply accountability principles and procedures at the local level.

Formal elaboration of a national strategic plan for rural water supply and sanitation has only occurred in the last few years. A Rural Water Supply and Sanitation Strategic Plan (PESA-ASR, also known as a Road Map) was developed in 2007, although not formally approved. This "defines the medium and long term vision, objectives, priorities and strategic guidelines for the WASH sub-sector with the aim of meeting the MDGs" (Alfai, 2010: 3). The Strategic Plan has since been developed into a National Rural Water Supply and Sanitation Programme (PRONASAR), which serves as the vehicle for a sector-wide approach by government and its development partners. During an initial phase (2010-2012), PRONASAR is being launched in 15 districts where no other major donor-funded water and sanitation projects are active. It is intended to absorb and integrate all rural water and sanitation interventions over the years to come, while ultimately serving as the single funding channel for donors' sector budget support. It retains the 2015 service targets, linked to the MDGs, that were quoted above.

NGOs play important roles in the rural water and sanitation sector. They are supposedly differentiated from the private sector by their not for profit status, but this distinction is often blurred in practice. In fact they function as part of the general pool of non-governmental service providers – as part of the private sector, in other words. Their principal role is

in extension, education and animation work at household and community levels – what is known in Mozambique as PEC (*partipação e educação comunitaria* – community participation and training). For this work they fill an important gap in currently available capacity, often working side by side with technicians in the district administration.

Since the enactment of the Water Law in 1991, the strategic emphasis has primarily been on enhanced water supply. In 2007, a National Water Resources Management Strategy was approved. This "comprises a comprehensive portfolio of water resources management projects and plans in such areas as water resources development; water resources assessment; monitoring; river basin management; flood risk analysis and disaster management; international rivers; establishment and further strengthening of regional water management entities (ARAs); administration of water law, water policy, regulations and utilisation; institutional strengthening and capacity building" (World Bank, 2007: 30). ARAs are meant to become financially self-sustaining through the collection of water use fees. They should play a major role in the future in integrated water resource management for Mozambique, providing a technical and institutional framework within which rural water supply would be assured. However, this lies some way in the future. Of the five ARAs, the one for southern Mozambique has made the most institutional progress. In the three provinces covered by the One Million Initiative, the ARA Centro, ARA Centro-Norte and ARA Zambeze have so far had little influence on rural water and sanitation interventions. Also in the longer term, a law on groundwater rights that is currently being prepared may affect public schemes that use these resources.

2.6 External funding agencies' policy and support to rural water and sanitation

Like many other countries, Mozambique has now experienced several years of debate and uneven progress with regard to the harmonisation and more integrated management of external support to its water and sanitation sector. In 2002 the Netherlands began to channel assistance through a sector budget support mechanism, ASAS. It continued this support through three phases of ASAS, to 2008. ASAS Phase IV runs to 2011. No broader sector-wide approach developed, however. Most other external funding agencies have been slow to engage with sector budget support. As elsewhere, they have often been more sceptical than the Netherlands (which also continues with more conventional bilateral project support through CARE in northern Mozambique and with UNICEF for the One Million Initiative). Meanwhile, a recent estimate suggests that development assistance made up some 85% of all investments in the water and sanitation sector over the last three years (WSP, 2010: 15). Modes of support range from Dutch funding through ASAS (on plan, on budget (i.e. structured into the Mozambique government's plan and budget) and host government discretional (i.e. managed and disbursed at host government discretion)) to the United States' Millennium Challenge compact (on plan, on budget but donor discretional) and many other externally-funded activities which are on plan and on budget but not passed through the Mozambique treasury and donor/lender discretional. From 2006,

government has been writing all significant externally funded projects on budget and on plan, even though disbursements often still do not take place through the national treasury. Despite the high levels of external support to the sector, overall disbursement rates are poor at 60%. "The reason for poor disbursement stems primarily from weak project management, especially by donors. 'On-treasury' funding is disbursed at a rate of 82%, as opposed to donor-managed projects which disburse at an average rate of 58%" (WSP, 2010: 15).

The Netherlands is a major supporter of the water and sanitation sector in Mozambique, as are the United States' Millennium Challenge Corporation, the World Bank, the African Development Bank (AfDB), UNICEF and the European Union. Other significant bilateral agencies giving assistance to this sector include the United Kingdom's Department for International Development (DFID), the Swiss Development Corporation (SDC) and Sida. Several international NGOs are also active, including Helvetas, CARE, World Vision and SNV. In total there are three multilateral and 15 bilateral agencies providing support to the sector. Achieving co-ordination and clear direction in this crowded landscape is a significant challenge for DNA and the Ministry of Finance. PRONASAR and its Common Fund are the key instruments for this purpose. The Netherlands and a number of other external funders, including AfDB, SDC, UNICEF and DFID, have committed support to the Common Fund. The AfDB has developed a programme for PRONASAR implementation in Nampula and Zambezia provinces with a planned budget of USD 20 mln, for implementation over three years from March 2011 with contributions to the Common Fund from The Netherlands and over a dozen other external funding agencies. Dutch sector budget support through ASAS is gradually being replaced by contributions to the Common Fund, through the GOM's Single Treasury Account (CUT). The latter is expected to make up some 12% of all external support to the water and sanitation sector in 2009-2011 (WSP, 2010: 14). By 2011, the Netherlands aims to be channelling at least 60% of its programme aid to the sector through it. PRONASAR does also offer parallel funding mechanisms for funders not yet ready to channel their support through CUT and the Common Fund, although "the outside-CUT funding option and the parallel mechanisms will be gradually abandoned as e-SISTAFE [the much improved State Financial Management System] is rolled out to all administrative levels, including Districts and as confidence [in] public financial management systems and tools increases" (Alafi, 2010: 4).

Several structures and procedures have gradually strengthened donor co-ordination and collaboration. Confidence in government's budget management (through SISTAFE,) is gradually growing – although monitoring and reporting remain weak. A general Programme Aid Partnership links government with all the funding agencies that provide at least some of their input as direct budget support or programme support. Budget support rose from 31% of all aid in 2004 to 38% in 2008, with programmatic support rising from 63% to 66% over the same period. In water and sanitation, government and development partners meet regularly at national level in the Water and Sanitation Group (GAS, currently chaired by UNICEF) and undertake Joint Donor Reviews. At provincial level, Water and Sanitation Thematic Groups (GTAS) meet monthly. Various agencies have signed up to the Code of Conduct for the sector, and in May 2010 an initial group signed the Memorandum of Understanding for the PRONASAR Common Fund. A recent assessment concluded that

> *The aid co-ordination atmosphere has improved significantly over the last decade. The joint review process has become more substantive, inclusive and collegial. Government budgeting, disbursement and procurement processes have improved considerably. Considering the available evidence, confidence in government's ability to manage donor funding and produce value for money is steadily improving. However, donor funding is still too fragmented, leading to an excessive administrative burden on government institutions, especially the DNA. Further development of SWAp arrangements will improve this situation, but will need to be accompanied by extensive capacity building.*
> (WSP, 2010: 12-13)

Government and the donor/lender community increasingly see PRONASAR as the way forward for the water and sanitation sector: both technically, as a way of integrating and replicating the best lessons on sustainable approaches, and institutionally, as a means of co-ordinating and merging external support to the sector under the strategic and budgetary management of the Government of Mozambique. As will be shown in this study, similar hopes are expressed about the technical and institutional sustainability of the One Million Initiative's approaches after 2013: UNICEF and DNA hope to see them maintained and more widely applied through PRONASAR.

2.7 Summary

The three provinces in which the One Million Initiative works – Manica, Sofala and Tete – are predominantly rural and have population densities below the national average. People generally live in communities of between a few hundred and a few thousand people, meaning that more than one water point per community is often necessary. They share a broadly common historical background, although there is great linguistic and cultural diversity. On the other hand, all communities are generally willing to pursue group action and responsibility in the development and management of local infrastructure. Most of the population live in poverty. Mozambique's Human Development Index for 2010 was ranked 165th in the world. The central zone of Mozambique, in which the One Million Initiative provinces lie, experienced an increase of 14.2% in the poverty headcount between 2002-03 and 2008-09. The baseline survey for the One Million Initiative found that 56% of female headed households fell into the poorest group, as opposed to 17% of households headed by men.

Rural people in Mozambique carry a heavy burden of disease, which is linked to the nutritional status of their children. Rates of HIV infection are high (12.5% of those aged 15 to 49 in 2007); malaria is a widespread killer; cholera outbreaks are common; diarrhoea is a commonplace for the rural and urban poor. There was deterioration in child stunting and wasting indicators between 2003 and 2008.
Groundwater resources are widely available in these three provinces. Their exploitation through boreholes equipped with hand pumps forms the technical backbone of rural water supply strategy. Salinity is a common problem in some areas, and deep aquifers sometimes necessitate more expensive pumps.

Mozambique's rural water and sanitation policy is rooted in the 1991 Water Law and the 1995 National Water Policy (revised in 2007). The national policy emphasises decentralised, autonomous and financially self-sustaining provision of water supply and sanitation services; a greater role for the private sector; integrated water resource management; recognition of water as an economic as well as a social good; more beneficiary participation; and a greater focus on capacity building.

Rural water supply principles reflect national policy. They give highest priority to the satisfaction of basic human needs with regard to water, taking into account the circumstances of the poor. All citizens should be able to obtain at least 20 litres of safe water per day from water points situated not more than 30 minutes' walk from their homes. The policy target until late 2010 was that each water point should supply 500 users; the recent recommendation is that this should be revised to 300 (PRONASAR, 2010).

Government should provide investment funds for rural water supply, but not build or operate them – these are functions for the private sector and for users respectively, with support from provincial and district authorities that are guided by the national Directorate of Water Affairs (DNA). District administrations and their planning offices spearhead state engagement in the sub sector. Users are expected to pay for their water supplies at a rate reflecting their economic value and thus covering the operation, maintenance and ultimate replacement of the infrastructure. User participation is therefore emphasised at all stages of the water project cycle.

An initial Rural Water Supply and Sanitation Strategic Plan has now been elaborated into a National Rural Water Supply and Sanitation Programme (PRONASAR), which serves as the vehicle for a sector-wide approach by the government and its development partners. During an initial phase (2010-2012), PRONASAR is being launched in 15 districts where no other major externally-funded water and sanitation projects are active. Government and the donor community increasingly see PRONASAR as the way forward for the water and sanitation sector: both technically, as a way of integrating and replicating the best lessons on sustainable approaches, and institutionally, as a means of co-ordinating and merging external support to the sector under the strategic and budgetary management of the Government of Mozambique.

Despite almost a decade of Netherlands commitment to sector budget support, most external funding agencies have been slow to engage with this concept. Achieving co-ordination and clear direction in the crowded donor/lender landscape for rural water and sanitation is a significant challenge for DNA and the Ministry of Finance. PRONASAR and its Common Fund are the key instruments for this purpose. Dutch sector budget support is gradually being channelled into the Common Fund. Government and development partners meet regularly at national level in the Water and Sanitation Group (GAS, currently chaired by UNICEF).

NGOs play important roles in the rural water and sanitation sector. Their principal role is in extension, education and animation work at household and community levels. For this

work they fill an important gap in currently available capacity, often working side by side with technicians in the district administration.
In 2007, a National Water Resources Management Strategy was approved. Regional water management entities are being established, but have so far had little influence on rural water and sanitation interventions.

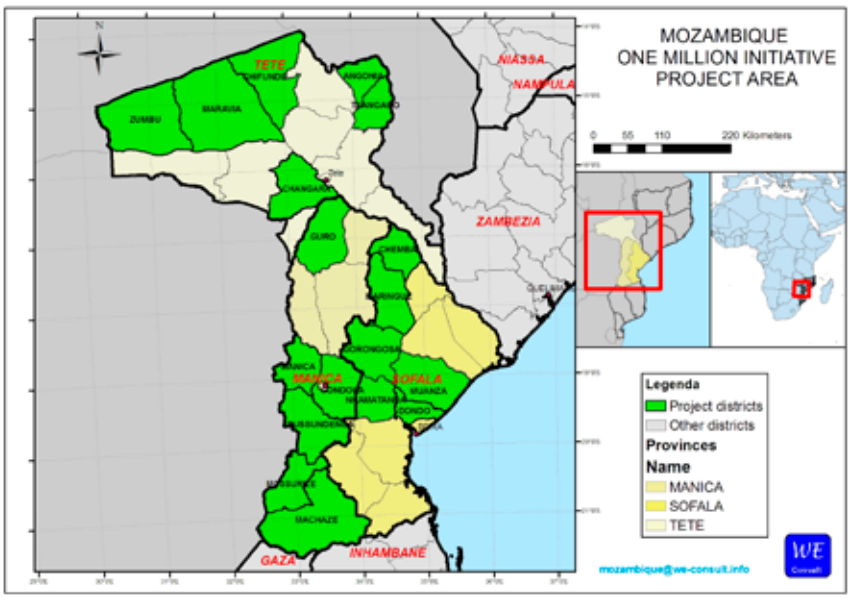
3

The One Million Initiative, 2006-2013

3.1 Objectives

The One Million Initiative is implemented as part of the Netherlands and UNICEF partnership to enhance water supply, sanitation and hygiene in eastern and southern Africa. Unusually, the programme proposal presents two logical frameworks with separate statements of overall objective and project purpose. The first is for the 'technical component' of the programme; the second, for the 'institutional component'. This design approach is not carried through to the main body of the proposal, however. There, five components are presented: rural sanitation, rural water supply, hygiene education, school sanitation and hygiene education, and community-based water resource management.

Figure 3 *Districts covered under the One Million Initiative*



According to the logical framework, the overall objective of the 'technical component' is "reduced incidence of water and sanitation-related diseases, particularly among the most vulnerable group (children and women) living in rural areas; increased economic growth and a higher ranking in the Human Development Index".

The project purpose for the 'technical component' is stated as follows:

> *To enable a minimum of 1.2 million currently un-served people to use domestic water from improved water sources, and 1 million to use improved sanitation facilities and adopt safe hygiene practices, such as handwashing with soap (or ash where soap is not available) after toilet use and before eating/feeding. To enable 140,000 school children to access and use improved sanitation, handwashing and water supply facilities in 400 primary schools. To ensure that 200,000 users have renewed access to safe water through*

the rehabilitation of their non-operational water points.
(GON and UNICEF, 2006: 12)

Five results are therefore shown in the logical framework for the technical component of the programme.

- *Increased access and use of safe drinking water from 44.4%, 45.9% and 66.8% to a least 70% in Manica, Sofala and Tete provinces respectively by 2011;*
- *Increased access and use of improved sanitation facilities from an average of 42% to at least 50% in Manica, Sofala, Tete provinces by 2011;*
- *Increased girls' enrolment and retention in 400 primary schools in Manica, Sofala and Tete provinces by 2011;*
- *Increased (at least 1 million) number of caregivers (particularly women) applying safe hygiene practices in the project area;*
- *Reduced... % of non-operational water points from 30% to 15% in the project area.*

(GON and UNICEF, 2006: 12-13)

The water supply objective combines a planned 200,000 people benefiting from an estimated 400 rehabilitated water points and 1,000,000 using 2,000 new water points. These plans were based on the GOM standard at the time of 500 users per water point.

The logical framework for the 'institutional component' of the programme states the overall objective as "increased access to water supply and sanitation by the targeted population, through improved management of sector funds and programme activities". The project purpose for this component is stated as follows:

Strengthened sector capacities (particularly at the sub-national level) to plan, co-ordinate, implement, supervise sector activities; document and disseminate sector lessons learned and good practices.
(GON and UNICEF, 2006: 15)

The five results shown for the 'institutional component' are:

- *Roles and activities of the different actors in this and other similar projects clarified;*
- *Planning, monitoring and evaluation systems improved;*
- *Districts and provinces provided with resources to meet the requirements of this and other projects;*
- *Competence and performance of the human resources of the sector developed to meet the requirements of this and other projects;*
- *Actual and future partner competence and performance improved, in order to respond to the complexity of this and other similar projects.*

(GON and UNICEF, 2006: 15)

3.2 Approach and activities

Introduction

Evaluation question 2 in the TOR for this review (Annex 1) asks about the approach and interventions adopted to tackle the problems that the One Million Initiative seeks to

address. This section and the section on institutional strategy below aim to answer this question. When the programme was launched, Mozambique had already made substantial progress in developing policy and approaches for rural water and sanitation (see Chapters 2 and 5). It has worked within these existing frameworks rather than inventing or imposing different strategies. It has nevertheless supported some significant improvements to approaches in the sub sector that have arisen from its operations so far.

The programme was launched in July 2006. The remainder of that year and much of 2007 were devoted to initial staffing, procurement and capacity building arrangements, although some community-level mobilisation (PEC) activities and rehabilitation of existing water points took place in 2007. Full field operations were under way from 2008.

Water supply

The programme's approach to rural water supply has focused on community water points equipped with hand pumps managed by new or revived village water and sanitation committees. These pumps extract groundwater, which is widely but not universally available in sufficient quantities, of suitable quality and at depths for which the standard Afridev pump is suitable. As shown above, the emphasis is on the construction of new water points, although rehabilitation of existing ones is also an important part of the approach. Increasing efforts have been made over the life of the programme to refine the technical approach so that communities in areas with more difficult conditions can also benefit. For example, the stronger Afripump has been introduced in some areas where suitable aquifers are found at greater depths, and a number of mini piped systems have been rehabilitated. The latter use a diesel pump to extract water from deep boreholes into a tank from which it is reticulated to a number of stand pipes as well as health posts and schools. In addition, the Mozambican authorities have urged the programme to support the rehabilitation of piped systems in several small towns. A proposal to do this in three towns within the area of the One Million Initiative was submitted to the Netherlands authorities in October 2009 but has not yet been approved.

The One Million Initiative's approach conforms to national policy in two important ways. First, it emphasises community ownership of water supply infrastructure, along with responsibility for operation and maintenance costs. Using PEC service providers to stimulate the formation of community water and sanitation committees, or revive the many moribund ones, has therefore been a central part of the programme's strategy. Communities are usually required to contribute MT 2,500 (EUR 56) before construction of a water point begins. Payment for use of the improved water supply is common, according to the 2010 field survey, which found that this was done at 79% of the sample improved water points where the programme had only improved the water supply. Where the programme had improved the water supply and undertaken sanitation interventions, payment was reported at 92% of the sample points. Usually, households pay each month. During community visits for this review, a monthly user payment of MT 5 – MT 15 per household was reported in most instances.

Borehole fitted with handpump

Secondly, the One Million Initiative puts strong emphasis on private sector involvement. Neither UNICEF nor government agencies are directly engaged in construction, supervision, repair work nor spare parts supply. Instead, the programme has taken various measures to stimulate networking between engineering and drilling companies, artisans and retailers – including, for example, the Drilling Association of Mozambique. The programme follows the government's procurement system and procedures. All engineering and PEC contracts are issued by the provincial Departments of Public Works and Housing. UNICEF observes but does not directly participate in tender review and contract award by the provincial authorities. It pays all contractors directly in consultation with the DPOPH, which obtains the relevant approvals from district authorities.

As it gained experience, the One Million Initiative has refined its technical approach to water supply in various ways. Contracting arrangements have changed. Initially, the programme used a third party management contract approach, employing engineering firms to undertake geohydrological investigations and supervise separately contracted borehole drilling contractors. Although there was good progress in drilling wells, many were negative and there was uncertainty about who should carry the responsibility for this ineffective expenditure. Since 2009, a turnkey approach has been adopted: drilling contractors are responsible for groundwater survey and must carry the responsibility for failed boreholes – a significant transfer of risk. Costs have also been reduced by limiting the fees for engineering supervision contracts to 15% of total construction cost and by promoting the use of cheaper light weight drilling rigs. Special efforts were made to ensure appropriate hand pump quality, following the identification of numerous sub-standard pumps and parts during the 2008 drilling programme. Tight criteria and procedures are now in place to ensure appropriate quality.

The contracting approach has also evolved with regard to the NGOs employed for PEC activities. Initially, these contracts focused on the submission of written deliverables. This was found to distract NGOs' attention from the substance of their work in the field. The

revised approach (from 2009) makes such contracts payable on the basis of achievement of targets in the field, using a series of indicators of sustainability, sanitation, new water point installation, hygiene promotion and HIV and cholera awareness.

Sanitation and hygiene

Drawing on its experience during 2008 (the International Year of Sanitation), the One Million Initiative revised its sanitation approach significantly. The programme was designed with separate components for rural sanitation and hygiene education. The Triple A approach (assessment, analysis, action) and participatory hygiene and sanitation transformation (PHAST) tools were to be used for hygiene education. The programme proposal's separate section on stimulating demand for rural sanitation referred to "an integrated planning approach to water, sanitation and hygiene" and the value of participatory methods for this purpose (GON and UNICEF, 2006: 43 and 32). In practice, the One Million Initiative found that "PHAST proved to be a slow tool in bringing about behaviour change and a difficult one to be mastered by facilitators on the ground" (UNICEF, 2010a: 9). It was decided to merge the sanitation and hygiene education components through a community-led total sanitation (CLTS) approach, in conjunction with an awards scheme for recognition of ODF status – this combined approach is usually being referred to as 'community approach for total sanitation' (CATS: Godfrey, 2009). At the same time, the programme has developed an integrated 'PEC Zonal' approach to rural water and sanitation extension work across its target districts.

Under the revised approach, contracted NGOs undertake a basic PEC Zonal programme of integrated water, hygiene and sanitation education and mobilisation across an entire district. They are awarded one year contracts for this work by the DPOPH. These contracts may be renewable subject to adequate delivery according to enhanced performance indicators (see above). The Netherlands Development Organisation (SNV) provides training to PEC NGOs and helps DNA to monitor their performance. The NGO employs animators, who in turn recruit and train activists at community level. The latter are local residents and receive a monthly stipend as well as bicycles to assist them in their work.

Having undertaken PEC Zonal across a district, the NGO then undertakes the more intensive CATS process in selected communities.

> *Community led total sanitation (CLTS) is an approach that uses participatory tools to trigger community self-analysis of their sanitation problems and the taking of a joint decision to make improvements... CLTS/CATS uses participatory rural appraisal (PRA) techniques (community map, transect walk, faecal-oral disease transmission demonstration) to trigger collective changes in sanitation practices... The CLTS approach requires good facilitation skills in order to 'capture the moment' when the entire community is triggered to take action on their sanitation situation. It requires a facilitator with the 'right' skills, which some of the animators is yet to acquire... A key 'triggering moment' is the demonstration of the faecal contamination of food.*
> (Godfrey, 2009: 6, 8, 9)

CLTS triggering is a direct and confrontational process in which people are plainly shown the links between the faeces they leave in the open and the frequent contamination of the food they eat, and take a 'walk of shame' through the community's defecation areas (WSP, 2007: 23-24). These participatory exercises are easier to achieve in small communities than in large ones (Godfrey, 2009: 8-9). If successful, the triggering induces every household in the community to build a latrine, and every individual to give up the practice of open defecation. In a process facilitated by the PEC NGO, communities then apply to be designated open defecation free (ODF).

> *...an incremental approach is promoted in CATS which focuses on the elimination of open defecation rather than the construction of individual toilets. This approach, while deviating from the previous approach that had informed the present project proposal, has proven to have a major public health impact in other countries as it encourages collective behaviour change.*
> (UNICEF, 2009: 10)

In 2008, a multi-agency evaluation team organised by UNICEF assessed the ODF applications made by 159 communities. This resulted in 34 communities being awarded ODF status. A generous hierarchy of prizes went with the awards. It is the ODF award system that distinguishes CATS from CLTS (Godfrey, 2009: 6, 17). Awards initially included prizes for the District Administrator of the district with the highest number of ODF communities and latrines and for the leader of every sub district or administrative post containing ODF communities. On the recommendation of a study commissioned by the programme (Godfrey, 2009), a more modest system of awards was instituted from 2009, when 619 communities were mobilised through the CLTS process and, despite the less generous prizes, 130 awarded ODF status (UNICEF, 2010a: 10).

Table 6 One Million Initiative ODF awards, 2008 and 2009-10

Award level	Award	2008	2009	2010
District Administrator	Photocopier or computer	Yes	No	No
Chief of Administrative Post [sub district]	Mobile phone or radio	Yes	No	No
Community Leader	Bicycle	Yes	Yes	Yes
Community	Water point or classroom	Yes	No	No
Community households	Hygiene kit	Yes	Yes	No

Source: UNICEF, 2009: 10

Communities designated ODF also receive a sign to this effect, usually erected at the entrance to the village. This process of application, evaluation and ODF award has captured popular and official imaginations and has proved a powerful incentive to enhanced sanitation practice.

ODF Community

> *Some doubts have been expressed as to whether the communities are actually ODF or have built latrines because of the award and the associated prizes. The findings indicate that the majority of the communities made collective decisions to improve their sanitation situation as result of the demonstration of faecal contamination of food during the triggering of CLTS and persuasion by their leaders post-triggering.* (Godfrey, 2009: 17)

Despite the growing popularity of the ODF concept, the approach remains a challenge at many levels. There are many reasons why some communities achieve more cohesion and common purpose than others, and may consequently find it easier to achieve ODF status. Even in a willing community, it only takes a few uncooperative individuals to preclude the required 100% achievement level. (On the other hand, the 100% requirement has not always been applied strictly: see the paragraph below). However, ODF is not the only result of CATS. Even if a community fails to erect the coveted ODF sign, a large majority of its people may have enhanced their hygiene and sanitation practices, despite the significant risks posed by a minority of non-adopters.

It is also important to recognise that avoiding open defecation is sufficient for adequate hygiene practice. Everyone may use a latrine, but the latrine may be dirty, or lack a lid; or appropriate handwashing may not be universal. A dirty latrine can even bring the risk of contamination closer to the household than previous defecation further away in the bush. ODF is therefore a step forward, but latrine condition and hygiene practice require ongoing monitoring and (where necessary) appropriate remedial action if sustainable sanitation progress is to be achieved.

The large majority of the latrines constructed as a result of the One Million Initiative have been built from traditional materials. Most of them (55%) do not have a slab or lid. Many households use a stone or other improvised lid to cover the opening. According to the JMP

classification[8] they are "unimproved". The programme has promoted the use of cement latrine slabs, although with limited success. From 2008, it facilitated the establishment of 32 demonstration centres at which latrine construction techniques could be seen. These centres were linked to the programme's efforts to form and support artisans' associations for the manufacture of slabs and the provision of water supply repair services, as well as efforts to stimulate local traders to stock and sell spare parts. Artisans were encouraged to form associations for slab manufacture and the provision of repair services, and in many cases the programme facilitated agreements between community water and sanitation committees and these associations, or individual mechanics, for maintenance and repairs. Although many effective links remain in place between committees and individual mechanics, the demonstration centres and the manufacture of latrine slabs at them have proved less successful, as have the artisans' associations.

There has been understandably limited demand for the more expensive concrete latrine slabs (despite the subsidy for their manufacture provided by the programme). These slabs are also difficult to transport (Godfrey, 2009: 16). It would be important to find out if these latrines are achieving the intended hygiene and sanitation benefits, even though the lack of a washable slab surface does not allow them to be defined as "improved" latrines according to JMP standards. Hygiene education has been integrated in the PEC and CLTS processes, and latrines built as a result of the One Million Initiative are often equipped with a simple handwashing facility that is used with soap or ash.

Schools

Design of the schools component took into account existing policy and programmes in Mozambique, with which UNICEF was already intensively involved. The programme proposal noted the work done by government, UNICEF and other partners since 2002 in developing a child-centred hygiene education programme at schools, which included the promotion of child-to-child sanitation committees. UNICEF had also supported the inclusion of water, sanitation and hygiene education in the school curriculum that was introduced in Mozambique in 2001 (GON and UNICEF, 2006: 45). Meanwhile, UNICEF has also been implementing a Child-Friendly Schools for Africa Initiative (CFS), which in Mozambique has been focused on seven districts. This "integrated multi-sectoral minimum quality package" includes water, sanitation and hygiene components (UNICEF, 2010b).

The One Million Initiative's schools strategy has been to align this programme component with the CFS and to launch implementation in the two CFS districts that are also One Million target districts. Following a baseline assessment of schools in each district, interventions involve the construction of water supplies and latrines as required (there should be one latrine per 50 pupils, equipped with simple handwashing facilities), together with hygiene education programmes that link schools with communities. The CLTS approach, termed School Led Total Sanitation, has also been used in the schools component, on the grounds that

[8] JMP is the Joint Monitoring Programme for Water Supply and Sanitation of the WHO and UNICEF. See WHO-UNICEF (2006).

- school children learn quickly and become active agents of change at the family level;
- the trigger of the school when done in parallel with the community may have a complementary effect;
- the trigger in schools can generate synergies between teachers and parents (school and community);
- the school is a place of concentration of many children (risk of spreading diseases);
- the proper disposal of faeces can reduce diarrhoeal diseases by 32%;
- the correct handwashing can reduce diarrhoeal diseases by 35%.

(UNICEF, 2010b)

Monitoring and sustainability

The monitoring approach originally established by the programme proposal envisaged that the One Million Initiative would be included in the regular planning and review process of the UNICEF country programme. The proposal also set out an independent third party monitoring approach: "building on sector experiences, sector co-ordination bodies such as the Water and Sanitation Co-ordination Working Group (GAS) and other sector partners working in the project area will be engaged to carry out independent project monitoring". These third party inputs were meant to complement routine monitoring and reporting by the implementing partners and by "communities analysing their community action plans and maps" (GON and UNICEF, 2006: 71).

A more elaborate and comprehensive monitoring approach has since been developed. At an early stage in the programme, UNICEF and the governments of Mozambique and the Netherlands agreed to include the One Million Initiative in a series of impact evaluations of Dutch funded rural water and sanitation interventions being carried out by the Policy and Operations Evaluation Department (IOB) of the Netherlands Ministry of Foreign Affairs. For this purpose a detailed baseline survey of 1,600 households was undertaken in August – October 2008 (WE Consult, 2009), followed up by a mid-term survey in the same months of 2010. The current review also contributes to the overall impact evaluation process.
In 2008, the One Million Initiative undertook the first of an annual series of sustainability checks (Godfrey *et al.*, 2009). These major exercises are contracted out to private sector service providers. In a sample of intervention communities, a series of assumed indicators of sustainability are investigated, spanning institutional, technical, social and financial factors. Using the same methodology, sustainability checks have now been carried out for 2008, 2009 and 2010.

The 2008 sustainability check showed that none of the communities surveyed had achieved what was judged to be a 'satisfactory' level of sustainability with regard to rural water supplies. This led the programme to investigate its operations and approaches in detail and renew its commitment to promote sustainability at all levels. This was done through a four phase sustainability action plan that included workshops at district and administrative post (sub district) levels to review the challenge of sustainability and measures to address it; followed by four principal initiatives in each area:

- the creation of a manual database for all water points in the district, which is now used as a monitoring and management tool at district (and sometimes administrative post) level.

Handwritten on flipchart paper, these databases show basic demographic data about each locality in the district, along with the numbers of working and broken hand pumps; information about user contributions to O&M costs; and numbers of improved and traditional latrines, bathrooms, drying racks and rubbish pits. This initiative was linked to on-going development of the National Information System for Water and Sanitation (SINAS: see below) and the introduction of GIS software for monitoring by provincial Departments of Public Works and Housing;

- the signing of agreements between local mechanics and community leaders for the provision of maintenance and repair services, so that in principle every community water and sanitation committee can call on its designated service provider for these purposes;
- the identification of local entrepreneurs who will procure, stock and sell spare parts;
- on-going preventive maintenance by community committees.

At present, despite the discussion of this issue in the programme proposal (GON and UNICEF, 2006: 42-43), water quality is not routinely tested. Conductivity and microbiological tests are done before a new water point is commissioned, but after the initial assurance that the supply is safe there is no subsequent regular monitoring. With the support of UNICEF, responsible government institutions are now developing a strategy to address this issue.

The National Information System for Water and Sanitation (SINAS) was launched in 2007 by the DNA and a number of development partners, including UNICEF. This is meant to become an integrated, harmonised national system on basic water supply and sanitation parameters. In the One Million programme districts, the initial steps towards the SINAS system have already been taken, with the creation of manual databases and the launch of data collection and monitoring procedures at community level (see below). SINAS is already populated with some data, with an inventory of point sources about 80% complete across the country. However, it is not yet fully operational or effective, following a generally slow process of development to date and the transfer of its previous co-ordinator to other duties. Additional Netherlands support may strengthen leadership of the system from 2011. Meanwhile, introduction of monitoring instruments and training of provincial and district personnel continue in various parts of the country, in the hope that SINAS may achieve fully national operation for rural water supply in 2012 and for rural sanitation in 2013.

The One Million programme's approach to institutional sustainability has combined the employment of additional staff to work at provincial and district levels (DPOPH and SDPI respectively, with additional M&E support from SNV); the training of government personnel and community members; and the provision of operating resources such as vehicles, motorcycles and computer equipment to DPOPH and SDPI offices in the target provinces and districts.

To build human resources in the target areas, the One Million Initiative has employed 30 technical staff: 12 have been posted to DPOPH offices and one to each of the SDPI offices in the districts covered by the programme. Government has agreed on a proactive strategy to transfer these posts to its establishment. In November 2010, 11 of these 30 positions had been transferred to the government payroll. Training efforts have included:

- training on construction quality control, water supply and quality, sanitation and financial management for 50 provincial and district technicians and supervising engineers;
- HIV/AIDS training for 86 provincial and district technicians and NGO staff;
- database management training for three provincial and 18 district technicians;
- training for PEC NGOs on CATS.

Sustainability has become an increasingly prominent theme in the training provided at community level by PEC NGOs, focusing on community water and sanitation committees and community leaders. This includes emphasis on efficient monitoring and record keeping as a necessary component of sustainability. Register books have now been designed and introduced for use by committees in recording group membership, payments, maintenance issues, events and expenditures.

3.3 Institutional strategy

This section addresses three evaluation questions posed in the TOR at Annex 1.

5. How did the institutional strategy for providing and sustaining works and services evolve?
6. Have roles and responsibilities been clearly defined? Are these adequately understood and fulfilled by beneficiaries and other stakeholders?
7. How did this strategy affect programme outputs?

The institutional strategy of the One Million Initiative has been to operate within the existing structures and systems of the DNA and of provincial and local government, working with these partners to develop and deliver institutional enhancements where necessary. UNICEF undertakes no direct implementation, except for monitoring: it contracts directly for the annual sustainability checks. Leading roles are given to district authorities, primarily through the SDPI, and to communities themselves.

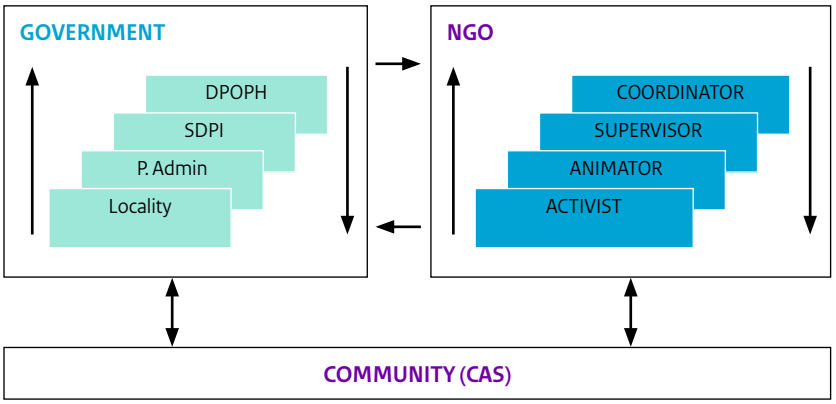
The programme has posted a regional technical team to work from the DPOPH offices in Beira. This small group of UNICEF staff and five consultants provides oversight, facilitation, support and training, working through the three DPOPH offices in Manica, Sofala and Tete provinces. Annual planning and programming of field activities (water supplies, PEC and CATS work and the schools component) are undertaken by the SDPIs in consultation with the DPOPH and the PEC NGOs, with support from the regional team. The DPOPH and SDPI offices have been strengthened with the professional staff referred to above, all of whom are expected to be on the government payroll before the programme ends.

As was noted earlier, the PEC NGOs play an important part in the field strategy of the One Million Initiative and are employed on one year contracts. Although they are required to undertake PEC Zonal work across entire districts, their subsequent more detailed hygiene and sanitation efforts inevitably concentrate on communities identified as more interested or socially ready to engage with CATS. These communities are identified in consultation with the district authorities, not solely by the NGO. It will take time and increasingly

challenging effort to fill in the current ODF patchwork and achieve total sanitation in all districts and communities. NGOs will find it harder to meet their targets – although growing experience will arguably sharpen their skills for this purpose. While it could be suggested that the current performance appraisal system for NGOs encourages them to work in 'easier' communities, it would be natural under any system to start where success is more likely and to tackle the more challenging communities later. Furthermore, the philosophy of the One Million Initiative and of Mozambican policy is that these changes are also the responsibility of individuals, families and communities. If some of these remain reluctant despite all reasonable encouragement, gaps in coverage will remain.

At district level, their senior staff operates as part of the SDPI team: programming their work jointly, sharing office space and often sharing transport. The DPOPH team in Beira (Sofala province) supplied the diagram of institutional structure and information flows reproduced in Figure 4. This shows the four levels of government administration and the PEC NGOs working side by side, with communication in both directions, and both structures interacting with communities and their water and sanitation committees.

Figure 4 *Co-ordination of activities and flow of information between provincial and community levels*



Source: DPOPH, Sofala

The community water and sanitation committee is at the heart of the implementation strategy at local level. The concept of such a user representative group was already well established in Mozambique prior to the One Million Initiative. The programme has therefore had to revive defunct or ailing committees in some places, and facilitate the establishment of completely new ones in others. These bodies are far from universal, however. The 2008 baseline survey found that only 22% of 161 water points reported having a committee, while in the 2010 survey the proportion had risen to 31% (of 245 water points). The percentage was 64% for the 42 improved water sources and 8% for unimproved water sources. In 2010 the percentage for the improved water sources was higher, 77% for 86

improved water sources as compared to only 5% for unimproved sources. And it was 21% at the 132 water points in the INE sample and 42% at the 113 water points in the PEC sample. Of the 75 committees reported at water point level in 2010, 68% had been established in 2008 or later. One third of them were reported to cover more than one water point in the community. At community level, the survey found that 61% of communities said that their water points were managed by a committee - all of which were said to be operational -, with 24% managed by community leaders (the most local government official, usually a traditional leader). Committees typically have between five and ten members, with a roughly even gender balance. The modal number of male members in 2010 was three, and of female members five. They commonly appoint a maintenance group with special responsibility for this function and for liaison with mechanics. In 2010, 72% of the 75 committees reported such a group. In addition to maintenance, committees' responsibilities include levying user charges and managing the funds received. In 2010, 82% of committees on which there were data reported having an account book, compared with 67% in 2008. Other tasks are locking and unlocking the pump, ensuring cleanliness and discipline at and around the water point, arranging repairs, promoting latrine construction and enhanced hygiene in the community and, in some cases, constructing and managing small gardens watered with runoff from the pump apron. In all this work communities are meant to be supported by the NGO activists, who are drawn from the local area and supervised by NGO animators, as shown in the Figure 4. The 2010 survey found that 36% of communities answering the question reported that their water committee met twice a year; 25% said that it met three or four times a year, and 15%, monthly. Another 15% said that the committee only met annually.

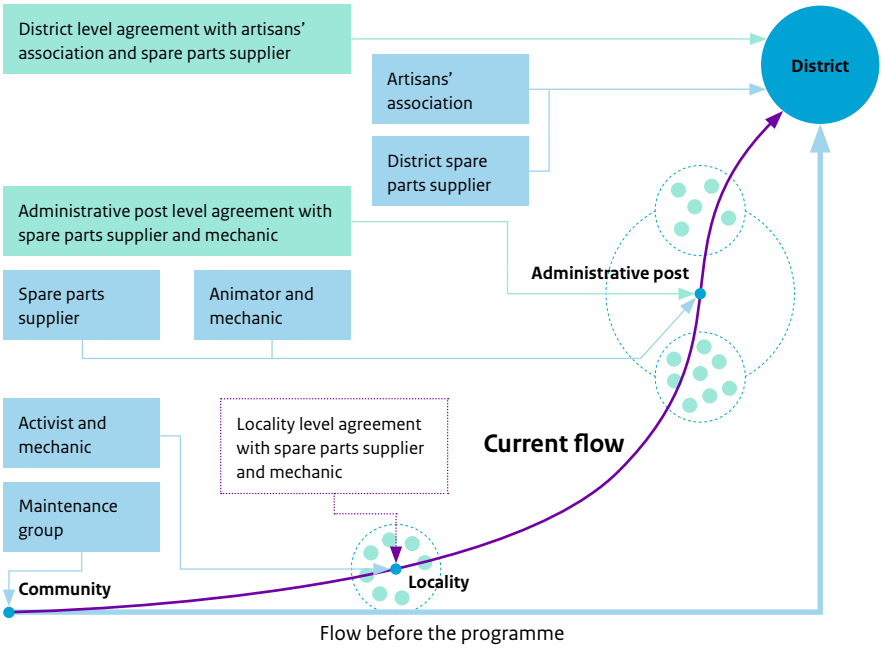
The issue of water user charges is discussed in section 4.3 below, which shows that most respondents who paid anything at all considered that the prices charged were reasonable or cheap. Asked in 2010 whether problems with their water points are sorted out quickly, 81% of communities that responded to the question said yes. The most common aspect of water point management said to require improvement was a faster reaction to problems (mentioned in 30% of communities), followed by improving the length of time for which water is supplied (23%) and improvements to accounting (23%).

When maintenance and repairs are needed, the water and sanitation committee may pay for them out of the funds collected through user charges, or it may collect additional money for the purpose. In the 2010 survey, half of 573 respondent households (286) said that they had contributed for repairs within the last 12 months. Pump repairs can take a long time: in 2010, it took more than three months to repair the last breakdown at 23 (52%) of 44 water points where repairs had been needed. Where spare parts had to be bought, they were procured from the district capital in 45 (67%) of the 67 cases; from the provincial capital in six (9%) of the cases, and from 'other' sources, possibly including mechanics and artisans, in 11 (16%) of the cases. One common reason why pumps surveyed in 2010 were not working does not augur well for sustainability: they had been 'abandoned' in nine (23%) of 40 cases of non-operation. In eight (20%) of the breakdown cases, the problem was the lack of one spare part; in seven (18%) a major rehabilitation was required.

The programme's emphasis on sustainability and on the role of pump maintenance and spare parts in assuring it has led to the investment of much institutional effort in building links between communities and mechanics, either singly or in artisans' associations. Building these links, and building an effective private sector support structure for rural water and sanitation, is not easy. Demand for parts is intermittent, scattered and limited – especially at present, when so much of the infrastructure is still new. Even when retailers can be persuaded that there is some business opportunity in stocking them, they are unlikely to have the liquidity to be able to buy and keep any significant level of stock when turnover is so low. Skilled mechanics are thin on the ground, and may not see work for community committees as their most lucrative line of business. The programme's strategy was to group them into associations, particularly so that it could contract with these groups for some of the initial construction work. However, the artisans have little experience of, nor necessarily much interest in, this mode of collaborative operation. As a result, few if any of the artisans' associations remain active, and the demonstration centres that were meant to be part of this strategy have mostly proved unsuccessful too. The 2010 survey found that ten (12.5%) out of 80 communities reported the presence of an artisans' association.

Despite these setbacks, the programme has made some progress with its institutional strategy of building a more participatory and broader-based structure of action and communication at the local level. The diagram reproduced in Figure 5 below is often used in One Million Initiative districts to show the way communications used to flow before the programme and the way they move now. Previously, communication (such as it was) was simply between the community and the district. Now, the two intermediate levels of local government – the locality and the administrative post – are also involved in the process. Maintenance groups are meant to be active at community level; the activist and mechanic at locality level, where there may be formal agreements with a spare parts supplier and a mechanic. These two private sector agents are also located at administrative post level, which is the territory usually covered by one NGO animator. Spare parts sellers are also likely to be found at the district capital. More in theory than in practice, there may be district level artisans' associations, and agreements at district level for spare parts supply and maintenance services.

Figure 5 *Agreements and information flows from community to district level*



Source: DPOPH, Manica

Overall, the institutional strategy of the One Million Initiative has achieved a clear definition and a reasonably widespread understanding of roles and responsibilities in the rural water and sanitation sub sector. Provincial and district staff understand very clearly how the system is meant to work: an example is their frequent reference to the arrangements shown in the figure. However, the institutional understanding is not yet fully embedded at the community level. That will take longer than the three years' effective operation of the One Million programme so far. Sustainable fulfilment of the various roles by the beneficiaries and other stakeholders is also a long-term goal. The signals to date are largely encouraging, with the exception of private sector engagement at the local level. Here, initial efforts to federate artisans and formalise service relationships between mechanics, entrepreneurs and communities have had unconvincing results. As Section 3.2 argues, external efforts to influence market relations and behaviour in the rural sector of developing countries are rarely successful.

3.4 Outputs to date

Evaluation question 3 for this review (Annex 1) asks about the main outputs of the One Million Initiative, compared to the targets that were set. Based on programme progress reporting targeted and realised outputs for water supply and sanitation facilities are described in this section.

Water supply

By the end of 2009 the One Million Initiative had rehabilitated a total of 392 water points. It had already reached its target number of 200,000 beneficiaries for this activity by the end of 2008, and the budget for this activity has been exhausted (GON, 2010: 6).

The programme has also made strong progress with the installation of new water points, as shown in Table 7 below. The construction of new water points began in 2008.

Table 7 New water points and beneficiaries, 2008 - 2010

	New water points (target)	New water points (actual)	% of target achieved	No. of beneficiaries enumerated
2008	280	306	109	385,456
2009	470	302	64	327,765
2010	406	386	95	254,523
Total	**1,156**	**994**	**86**	**967,744**

Sources: GON, 2010: 7 and programme data

The target for 2010 shown in the table is the one communicated by the programme in its 13 November performance update. The annual programme report for 2009 shows a target of 406 boreholes and "130 communities with alternative technological options e.g. rainwater harvesting, spring protection and mini piped water supply schemes" (UNICEF, 2010a: 14).

It can be seen that the One Million Initiative is reaching its target number of beneficiaries, at 97% of the planned 1,000,000, even though it has completed only 49% of the target 2,000 new water points. The average number of beneficiaries per water point so far is 989. Beneficiary numbers are counted and reported by the PEC NGOs. The programme average is substantially higher than the government norm (until recently) of 500 per water point, and higher still than the proposed new planning standard of 300.
Water point construction performance has been relatively even across the programme provinces and districts, although in Mwanza district of Sofala province only four of the year target of ten water points were completed in 2010.

In 2009 the programme rehabilitated three mini piped water supply systems based on a deep borehole equipped with a diesel pump and a reticulated supply to a number of community stand pipes and public facilities. A further six systems have been rehabilitated in 2010 in Machaze and Nhamatanda districts. These activities have been part of the steady expansion of the programme's technical focus beyond the primary emphasis on boreholes equipped with Afridev pumps. Alternative Afripumps for deeper boreholes have been investigated and installed in some areas. Elsewhere, technologies such as rainwater harvesting, shallow wells and spring protection works have been explored and applied.
A total of 130 communities were planned to be served with alternative water technologies in 2010. Further installations using these methods will be tendered by the One Million Initiative in 2011.

The numbers reported in Table 7 can be compared to numbers estimated on the basis of the survey data, as shown in Table 8.[9] According to this table the number of newly created water points is estimated to be 449, much lower than the number of 994 reported in Table 7. However the estimated number reflects the situation of August 2010. According to programme records 136 new water points had been created by that date rather than the 333 reported in Table 7. The estimate of 449 new water points must therefore be compared to a reported total of 744 (= 306+302+136). The estimate of 449 is not very precise; the 95% confidence interval for the estimate is from 117 to 782. The lower statistical estimate of 449 new water points could therefore well reflect sampling error.

Table 8 Number of new water points, estimated from survey data

Water Points Created	Total	Standard error	95% confidence interval	
All water points	833	257	313	1352
Rehabilitated	383	169	41	726
New water points	449	164	117	782

Source: authors' calculation based on programme information and sample analysis

Sanitation and hygiene

The CATS has resulted in rapid progress with regard to latrine construction. Table 9 shows that the programme has already exceeded its target of 1,000,000 people with access to improved sanitation facilities. As discussed in section 4.4 owning a latrine results in using it as well.

Table 9 New latrines and beneficiaries, 2008 - 2010

	New latrines		Beneficiaries		
	Planned	Actual	Planned	Actual	% of target beneficiaries
2008	6,000	55,200	30,000	276,000	920
2009	121,000	66,000	605,000	330,000	55
2010	50,000	83,815	250,000	481,118	192
Total	**177,000**	**205,015**	**885,000**	**1087,118**	**123**

Sources: GON, 2010: 9 and programme data

The primary target of the CATS is the declaration of communities as open defecation free. Table 10 shows that significant numbers of people in the programme provinces are now living in ODF communities, although they are far fewer than the total number who are using improved sanitation facilities. This year's programme progress review for the Netherlands government stated that "the number of ODF communities is the best indicator for progress in the sanitation and hygiene component of the programme. The programme will report in the future on the number of ODF communities and the progress that is being

[9] Annex 2 explains how these estimates were derived.

made on the sanitation ladder (concretely the proportion between improved and traditional latrines)" (GON, 2010: 10). As noted in Section 3.2, there has been debate about the relevance of formal definitions of 'improved' latrines. Focusing assumed programme benefits only on communities declared ODF would be debatable too, given that many households in communities that do not achieve this status are also benefiting from latrines that the programme has stimulated them to build.

Table 10 ODF communities, 2008 – 2010

	Triggered	Declared ODF	Population of ODF communities
2008	159	34	26,000
2009	619	151	124,835
2010	0	248	198,408
Total	**1,467**	**433**	**349,243**

Source: programme data

Overall, the programme reports a reduction in open defecation across the target provinces from 66% of the population in 2007 to 30% in 2009. Table 11 gives more detail on the ODF process for 2010. All the communities declared ODF in that year had been triggered during the 2008 and 2009 campaigns, as there was no new triggering in 2010 (Table 10). Achieving this status implies a major behavioural change for the target population, and is far from being the immediate or automatic result of the ODF process. That is why the planned number of ODF declarations (i.e. the estimated ultimate success rate) shown in the table is much less than the number of communities planned for CATS coverage.

Table 11 Communities planned for CATS evaluation, evaluated, declared ODF, 2010

Province	Planned	Evaluated	Declared ODF	Planned ODF	% of ODF target achieved
Manica	280	181	93	95	98
Sofala	237	218	75	115	65
Tete	172	146	80	85	94
Total	**689**	**545**	**248**	**295**	**84**

Source: programme data

Programme outputs with regard to hygiene are less specifically reported. The programme delivers hygiene education activities as part of the PEC Zonal and CATS processes. It reported that in 2008 it "reached 500,000 people in rural areas in 18 districts with social mobilisation and hygiene promotion activities and adopting appropriate hygiene practices" (UNICEF, 2009: 8). For 2009, it stated that "327,765 people were reached with social mobilisation and hygiene promotion activities, to adopt appropriate hygiene practices such as handwashing with soap or ash and safe excreta disposal through the use of basic sanitation. This exceeded the 257,000 target" (UNICEF, 2010a: 5). Chapter 4 presents this study's findings on changes in hygiene behaviour between the 2008 baseline survey and the 2010 mid-term survey.

Schools

Outputs from the programme's schools component have lagged somewhat behind plan so far, as Table 12 shows.

Table 12 School water supplies and latrines, 2007 - 2010

	School water supplies				School latrine facilities			
	Planned	Built	% of plan	Pupils	Planned	Built	% of plan	Pupils
2007	50	47	94	?	10	-	0	-
2008	30	30	100	10,500	30	30	100	10,500
2009	80	66	83	23,100	240	60	25	14,000
2010	40	22	55	9,370	60	162	270	18,900
Total (2008-2010)	**200**	**165**	**83**	**42,970**	**340**	**252**	**74**	**43,400**

Sources: GON, 2010: 8 and programme data. No data on pupil numbers in 2007. No school latrine facilities built in 2007

The 2010 field survey found that 52 (87%) out of 60 school drinking water points were working without problems; two were working imperfectly and six were out of order. Almost all (95%) of these school water points had maintenance groups, typically made up of members of the general community rather than parents of schoolchildren specifically.

Up to December 2010, 362 out of 501 schools that had been implementing School Led Total Sanitation were awarded ODF status (UNICEF, nd (a): 1).

3.5 Costs

This section addresses evaluation question 4 about the key costs and cost trends in the One Million Initiative to date.
The total budget for the One Million Initiative, over six years, is USD 42.82 mln, made up as follows.

Table 13 Budget of the One Million Initiative

Funding source	Budget contribution		% of total
	EUR mln	USD mln	
Government of the Netherlands	21.57	28.30	65
UNICEF	6.03	7.91	19
Government of Mozambique	4.22	5.53	13
Beneficiary contributions	0.82	1.08	3
Total	**32.64**	**42.82**	**100**

Source: programme data

The 2010 GON review of programme performance cited a cost per beneficiary of a rehabilitated borehole of EUR 3.81 (USD 5.00), and a cost per beneficiary of a small piped system rehabilitated by the programme as EUR 5.03 (USD 6.60). It calculated that the depletion of the borehole drilling budget was in line with the number of boreholes drilled to date relative to the target of 2,000. However, it noted that the programme had yet to drill in areas where costs were likely to be higher, and concluded that average costs per borehole would have to be reduced further if the target is to be achieved within budget (GON, 2010: 7-8). Since 2008, the One Million Initiative has taken a number of measures to enhance the efficiency of drilling contract management and lower the average cost per borehole. In 2008, that cost was EUR 10,772 (USD 14,130). This was two to three times the cost per borehole (in 2006) in Ethiopia, Ghana, Mali, Niger, Uganda and Ghana (UNICEF, nd (b): 1). It was reduced to EUR 6,680 (USD 8,762) in 2009 and EUR 5,255 (USD 6,893) in 2010. Based on the nominal number of 500 beneficiaries per borehole this amounts to USD 14 per capita.

The 2010 GON review also notes that "the CLTS approach, introduced in 2008, has really boosted latrine construction and reduced unit costs" (GON, 2010: 9). The programme itself has reported that "with the introduction of the CATS, there has been a significant increase in community contribution, with communities meeting the full cost of the materials and the construction of their latrines. This cost has been estimated at… approximately USD 10 [EUR 7.62] per latrine" (UNICEF, 2010a: 18). For the average 5-person household the per capita cost is therefore approximately USD 2. However, these construction costs exclude the cost of delivering the CATS to communities, on which data are not available.

No more specific data on the costs of the One Million Initiative are currently available. However, Mozambique is one of four countries in which the WASHCost project is currently working to collect and analyse cost data for water and sanitation services in rural and peri-urban areas (WASHCost, 2010: 2). Reviewing 29 water point construction contracts undertaken in 2009, the project found that the average cost was EUR 5,891 (USD 7,727, MT 255,000). This is lower than the average cost incurred by the One Million Initiative in 2009, but higher than the cost it achieved in 2010, as shown above.

3.6 Summary

The One Million Initiative, launched in 2006 and operating to 2013, is implemented as part of the Netherlands and UNICEF partnership to enhance water supply, sanitation and hygiene in eastern and southern Africa. It has a budget of EUR 32.64 mln, of which 65% is provided by the government of the Netherlands, 19% by UNICEF, 13% by the government of Mozambique and 3% by beneficiary contributions.

Its overall technical objective is "reduced incidence of water and sanitation-related diseases, particularly among the most vulnerable group (children and women) living in rural areas; increased economic growth; and a higher ranking in the Human Development Index". Its overall institutional objective is "increased access to water supply and sanitation by the targeted population, through improved management of sector funds and programme activities".

The programme therefore aims to benefit 200,000 people with 400 rehabilitated water points and 1,000,000 people with 2,000 new water points. Through sanitation and hygiene education activities it aims to increase access to and use of improved sanitation facilities from an average of 42% to at least 50% in Manica, Sofala, Tete provinces by 2011: the intention was to facilitate the construction of 200,000 new latrines. Water supply, latrine construction and hygiene construction in 400 primary schools serving 140,000 pupils and teachers should lead to increased girls' enrolment and retention.

The programme's approach to rural water supply has focused on community water points equipped with hand pumps, managed by new or revived village water and sanitation committees, which extract groundwater. It emphasises community ownership of water supply infrastructure, along with responsibility for operation and maintenance costs. It also puts strong emphasis on private sector involvement in construction and maintenance. Various innovations in contracting conditions and procedures have significantly reduced construction costs. Community facilitation and institutional support are mainly provided by NGOs contracted with programme funds. Again, the programme has achieved stronger NGO performance through enhanced contracting arrangements.

The One Million Initiative has replaced its original participatory hygiene and sanitation transformation (PHAST) approach with a community approach for total sanitation (CATS), combining community-led total sanitation (CLTS) with an award system for communities that achieve open defecation free (ODF) status. This has accelerated performance. If successful, the confrontational CLTS triggering process induces every household in the community to build a latrine, and every individual to give up the practice of open defecation. NGOs undertake a broad-based extension process across entire districts, laying the foundations for water supply work and for more intensive CLTS activities in selected communities, leading ultimately to community applications for ODF designation.

The large majority of the latrines constructed as a result of the One Million Initiative have been built from traditional materials. The programme has also promoted the use of concrete latrine slabs, although with limited success.

The programme's work in schools has been merged with UNICEF's existing child-centred hygiene education programme and the Child-Friendly Schools for Africa Initiative. Interventions involve the construction of water supplies and latrines as required, together with hygiene education programmes that link schools with communities.

To build human resources in the target areas, the One Million Initiative has employed 30 technical staff: 12 have been posted to DPOPH offices and one to each of the SDPI offices in the districts covered by the programme. Government has agreed a proactive strategy, now well advanced, to transfer these posts to its establishment.

The One Million Initiative has given detailed attention to monitoring and the progress towards sustainability that monitoring should reveal. It has now undertaken three annual, wide-ranging 'sustainability checks'. The disappointing findings of the first of these (in

2008) prompted a comprehensive review and refinement of programme strategy. Measures taken include the introduction of manual database procedures at district level and the facilitation of signed agreements between communities and private mechanics and traders for maintenance and spare parts supply. (The strategy of linking artisans into associations based at demonstration centres has been largely unsuccessful.) The programme's monitoring system is meant to feed into the emerging National Information System for Water and Sanitation (SINAS). There is no system for water quality monitoring yet, although steps are being taken to establish one.

Overall, the institutional strategy of the One Million Initiative has achieved a clear definition and a reasonably widespread understanding of roles and responsibilities in the rural water and sanitation sub sector. Provincial and district staff understand very clearly how the system is meant to work. Institutional understanding is not yet fully embedded at the community level. That will take longer than the three years' effective operation of the One Million programme so far. Complete fulfilment of the various roles by the beneficiaries and other stakeholders is also a long-term goal. The signals so far are largely encouraging, with the exception of private sector engagement at the local level.

The One Million programme's strategy has had a number of positive effects on its outputs. The capacity of communities, local government, NGOs and the private sector has been built and combined with largely beneficial results, accelerating delivery and reducing costs. By the end of 2009 the One Million Initiative had rehabilitated a total of 392 water points, completing this element of its work plan. By the end of 2010 it had built 994 new water points. The number of users enumerated at these new water points totalled 967,744, implying an average of 974 users per water point. The programme is thus nearing its target number of beneficiaries.

Due to its replacement of PHAST with the CATS, the programme has already nearly reached its target of one million people using improved sanitation facilities. Over and above these planned targets, 466 communities have so far been declared ODF. The performance of the schools component has been slower, although (again moving beyond the original strategy) 362 schools had been declared ODF by December 2010.

The programme has reduced borehole construction costs from EUR 10,772 in 2008 to EUR 5,255 in 2010, although work in more difficult areas in 2011 may drive average costs up again. The CLTS approach to sanitation has significantly reduced the cost of building a latrine, which is now estimated at EUR 7.62.

4

Impact analysis

4.1 Introduction

This chapter analyses the impact of the One Million Initiative in the provinces Manica, Sofala and Tete. It addresses evaluation questions 8-25 listed in chapter 1. The chapter is organised as follows. In Section 4.2 data and methodology are discussed. Section 4.3 analyses the survey evidence on households' use and access to improved water sources (evaluation questions 8-13 and 17-19). Section 4.4 discusses sanitary facilities and hygienic practices (evaluation questions 14-15). Section 4.5 uses statistical impact evaluation to analyse the impact of programme interventions on health (evaluation question 16), while the impact on educational outcomes is discussed in Section 4.6 (evaluation questions 20-25). For each of the evaluation questions a summary of the findings is presented first. This is followed by a detailed discussion of the evidence on which the summary is based after which a more detailed discussion follows. Section 4.7 concludes and contains a summary of the most important findings.

4.2 Data and Methodology

In order to obtain direct evidence on the impact of the One Million Initiative a random sample was drawn of 80 communities from 9 of the 18 districts covered by the Initiative. Details about the sampling procedure can be found in Annex 3. Half of the sample, or 40 communities, is representative of the general population of the 9 sample districts. This part of the sample has been drawn on the basis of the 1997 census and will therefore be called the INE sub-sample.[10] The other 40 communities were drawn from a poorer 'target' section of the population. When the sample was drawn in 2008 this part of the population was expected to be more intensively targeted by the One Million Initiative. This part of the sample is based on an enumeration of communities by PEC[11] staff and is therefore called the PEC sub-sample. Thus, the complete sample of 80 communities has intentionally oversampled locations which could become 'treatment communities' in order to get a better picture of activities under the One Million Initiative and achieve greater statistical precision when comparing (high intensity) treatment to no treatment (or low intensity treatment) communities. As a result of the randomization the INE sub-sample can be used to estimate statistics at the level of the general population and the PEC sample can be used to zoom in on a poorer section of the population. The two sub-samples can be combined to investigate the impact of interventions of the One Million Initiative.

For each of the sample communities a number of surveys have been carried out: a household survey was conducted among 20 households selected by systematic sampling from a randomly chosen contiguous group of approximately 100 households (comprising around 500 persons). This survey covers general household characteristics, as well as water, sanitation and hygiene practices. In addition, a focus group discussion and water point survey was conducted in the smaller community in which the 20 sample households are

[10] The census was conducted by INE (Instituto Nacional de Estatistica), the national bureau of statistics.
[11] See section 2.5 for information on the PEC.

living. Water samples were taken at a selection of households (10% of sample) and at the water sources used by these households to test for microbiological contamination.[12] A separate survey has been conducted among 80 schools from the 2 programme districts participating in the Child Friendly Schools for Africa Initiative (CFS), see page 54. These districts are not covered by the other surveys. All sample households, schools and communities have been visited twice, in 2008 and 2010, and will be visited again in 2013.

The sample design differs in an important way from the conventional treatment/control comparison. When the sample was drawn UNICEF indicated that treatment and control groups should not be distinguished *ex ante*, since this would involve telling some communities that they would not benefit from the Initiative or only at a later stage. As a result control and treatment groups can be identified only *ex post*. This has an important implication: the effects of the Initiative cannot be assessed by simply comparing the outcomes for treatment and control villages since treatment villages were not selected randomly. They may well differ systematically from control villages, if only because poorer villages were more likely to receive treatment. Such selection effects obviously invalidate the customary treatment-control comparison.

The econometric technique of 'difference in differences' estimation overcomes most if not all such concerns. This method focuses on *changes* over time rather than on *levels* of variables. For example, if the prevalence of water borne diseases is found to be higher in treatment villages than in control villages, it is clearly not legitimate to conclude that the health effect of water and sanitation interventions was perverse: presumably treatment villages already had a higher prevalence. But suppose that initially prevalence was 50% in villages which later received treatment and 30% in control villages and that after the interventions prevalence was 25% and 20% respectively. Then it is natural to assume that without the interventions prevalence in the treatment villages would have fallen as much as in the control villages, i.e. by 10 percentage points. In fact a much larger fall is observed: from 50% to 25%, i.e. a fall of 25 percentage points. It is the difference between these two changes over time - in fact a difference between two differences hence the terminology "difference in differences" or double differencing" - which is of interest. Since prevalence fell 15 percentage points more in the treatment villages than one would expect on the basis of the trend observed in the control villages there is a *prima facie* case that this measures the causal effect of the intervention.

This is the approach usually employed in this report. Nevertheless this report also includes some cross-sectional tables comparing *levels* of outcomes rather than changes. Because of the selection problem any findings based on such level comparisons cannot be considered as causal effects. On the other hand one would expect that the lower living standards in the treatment communities mentioned above have an unfavourable effect on many outcome variables. This means that any favourable effect of the intervention suggested by a compari-

[12] Also, information from health posts close to the sampled location has been collected that can be linked to the various samples. This information includes the number of recorded cases of particular diseases and disease-specific mortality data. However, this information could not be used since the catchment area of a health post is too large to identify the effect of the interventions.

son of levels is likely to be an underestimate of the true effect. In this sense the cross-section comparison can still be useful.

Technically, the method of double differencing is implemented by regressing changes (over time) in a variable of interest such as the prevalence of diarrhoea on a number of 'explanatory' variables, including a variable indicating whether a location has received an intervention (say, hygiene promotion) in the period considered. If the regression coefficient for that variable is statistically significant, then that is evidence that the intervention has resulted in an improvement in health. The confounding effect of determinants of health not included in the regression is largely eliminated by this procedure.[13]

This method can be extended by including more intervention variables in the explanatory variables of the regression, e.g. in addition to hygiene training the availability of safe water sources, latrine construction and so on. (This is extremely useful since the One Million Initiative in fact amounts to a combination of interventions) The regression coefficients estimated for these variables indicate how much impact (in terms of reduced diarrhoea) is caused by a change in that variable. The results therefore not only indicate what works but also by how much.

For proper understanding of the many regression tables in this chapter it is useful to consider an example. The following table is a copy of Table 18.

Copy of Table 18: Change in use of improved water sources caused by change in availability of improved water sources and / or CATS intervention				
Mean value dependent variable: 0.277				
	Estimate	**Clustered Standard Errors**	**t-value**	**Pr(>|t|)**
(Trend)	0.072	0.043	1.68	0.094
Water point intervention in location = 1, otherwise =0.	0.318	0.089	3.57	0.000
CATS intervention in location = 1, otherwise = 0	0.159	0.093	1.71	0.087

Source: data from household survey and programme data on interventions. The dependent variable is equal to 1 if a household switches from unsafe to improved water sources, -1 for a switch from safe to unsafe sources, and 0 if the source type has not changed. N = 1310. Only households interviewed in both survey rounds have been included. Adjusted R-squared: 0.170

The aim of the regression is to explain the 'dependent variable' which is defined in the Table's caption as the change in the household's use of improved water sources. The dependent variable is equal to 1 if a household switches from unsafe to improved water sources, -1 for a switch from safe to unsafe sources, and 0 if the source type has not changed. The average value of the dependent variable is given at the top of the Table as

[13] The notable exception is the case where the variable of interest, say diarrhoea prevalence, is affected by unobserved variables which change over time. (If unobserved variables do not change over time the differencing procedure eliminates the bias they might cause.)

0.277. This means that in the sample there was a net increase of 28 percentage points in the use of improved water sources. The dependent variable is related to the 'explanatory' or 'independent' variables listed in the first column. In this case they include an autonomous *trend*, a variable representing *water point interventions* and a variable representing *CATS interventions*. The main effects are given in the second column, headed 'Estimate'. The precision of the estimated effects can be gauged from the third column, which contains standard errors: precision is higher if the standard errors are smaller compared to the estimated effects. Throughout this Chapter 'clustered' standard errors are used to account for the fact that households have been sampled from a limited number of locations. Columns four and five contain t- and p-values and indicate the statistical significance of the estimated effects. A high t-value (above 2 or below -2) and a low p-value (below 0.05) indicate high significance. For instance, a CATS intervention in a household's community increases the probability that the household switches to an improved water source by an estimated 15.9 percentage points. However, this estimate is not very precise, with a standard error of 0.093, or 9.7 percentage points, resulting in a relatively low t-value (1.71) and correspondingly high p-value (0.087). At this level of significance (8.7%), many would not dismiss the possibility that the estimated impact of the CATS intervention is an accidental result of sampling rather than reflecting impact.

A moot point is whether the results of a regression justify a causal interpretation: can one conclude that the dependent variable is caused by (some of) the explanatory variables or is the regression merely expressing correlation between variables which could stem from other processes? In the case of double-difference regressions the effects of many of such potential 'other processes' are filtered out, warranting a causal interpretation.

4.3 Water interventions of the One Million Initiative

Evaluation question 8. What has been the average number of users per improved water point in the sample?

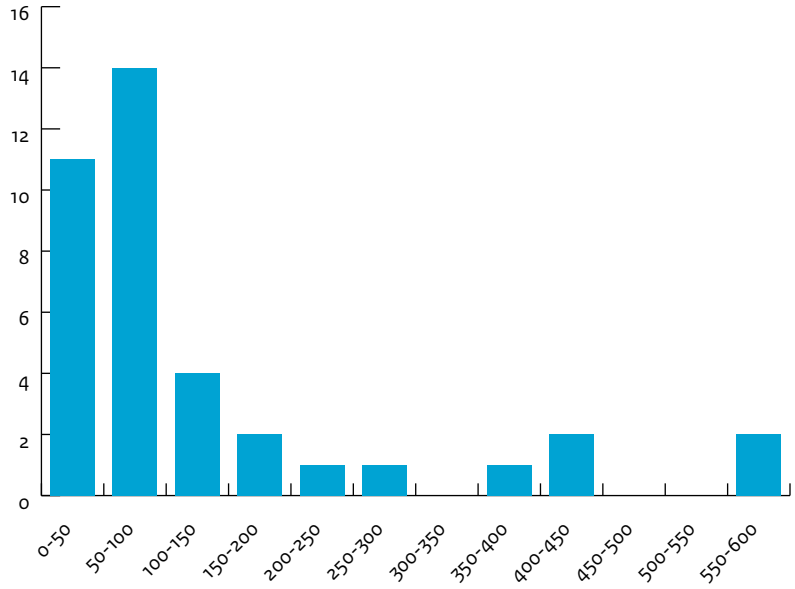
> *There has been a massive increase in the number of sample households using improved water points between 2008 and 2010. However, the number of improved water points is still far below the target of one water point per 500 persons. The average number of persons per improved water point has fallen, especially in the (targeted) poorer section of the population, where it declined from around 3570 in 2008 to 1250 in 2010.*

Survey data do not allow a precise answer to this evaluation question. The 2008 and 2010 rounds of the Water Point survey included a question on the number of households served by the water point in the dry and rainy seasons. However, this question was asked only for water points with payment and it was answered only for 38 (44%) of the improved water points concerned. Figure 6 shows the outcomes for these 38 water points in the dry season.[14] The question expresses the concern that water points may serve more than the 500 persons they are nominally supposed to serve. Such excessive use of water points could lead to early

[14] The graph for the rainy season is almost identical.

failure or long waiting times at the pump. Indeed Figure 6 shows that only 66% of these 38 improved water points report less than 100 families as users, while some water points serve as many as 600 households. Note, however that these data are not very reliable due to the limited number of responses.

Figure 6 *Number of water points by number of households served (dry season, 2010)*



Source: Water Point survey 2010

The number of users also affects the quantity of water per capita per day that can be obtained from the improved source. Comparing the population numbers reported in the community surveys to the available number of improved water points it follows that there were 2,971 persons per functioning improved water point in the sample areas in 2008, and 1,387 in 2010, showing that there is still a vast shortage of improved water points and, consequently, that the usage intensity of improved water points is likely to be much higher than desirable.

Table 14 summarises the presence of improved water points in the INE and PEC sub-samples. One can deduce from the Table that the population per functioning improved water point in the INE sample was 2,571 in 2008, and 1,543 in 2010. The improvement was markedly better in the PEC sample, where population per functioning improved water point was 3571 in 2008, and 1,250 in 2010 (using 2008 population numbers). This reflects the worse initial conditions for the PEC section of the population, as well as the targeting of programme interventions at this group.

Borehole fitted with handpump

Table 14 Improved water points in survey locations

	INE sample		PEC sample	
	2008	2010	2008	2010
Improved water Points	32	56	26	49
Functioning Improved water Points	21 (66%)	35 (63%)	14 (54%)	40 (82%)
Population[15]	54,000		50,000	

Source: Household survey[15]

These survey based numbers are worse than the official figures for the three provinces covered by the One Million Initiative. Table 15 summarises government data on the access to water from improved sources. According to this Table access to an improved water point in 2009 was available to 59% of the population in these three provinces. The population per functioning improved water point according to the table is 956 in 2007 and 875 in 2009. This is much better than the sample-based estimates mentioned above. A possible explanation for the difference is that there are relatively more improved water points in the districts not covered by the survey.

[15] Population numbers are from the Community Surveys. These are very rough estimates. Hence population numbers have been rounded to the nearest 1000. The estimates for 2010 and 2008 do not match well. Therefore only numbers for 2008 have been included. Population growth in Mozambique is around 2.5% per annum. According to the 1997 Census the 9 sample districts had a population of 818,797 persons. A rough estimate for 2008 is therefore 1.07 million suggesting that around 1 in every 20 persons is living in communities covered by the survey.

Table 15 Access to improved water points

	Population (thousand)		Number of functioning improved WP		Improved WP coverage (%)	
	2007	2009	2007	2009	2007	2009
SOFALA, overall	1141	1184	1288	1390	60.5	60.8
Nhamatanda	235	255	116	189	25.5	37.9
Muanza	11	10	19	34	100.0	100.0
Gorongosa	97	99	53	108	27.4	54.6
MANICA, overall	1063	1077	1116	1378	56.2	66.4
Gondola	215	178	251	309	59.1	88.1
Sussendenga	141	149	100	160	40.3	59.4
Guro	51	52	103	141	100	100.0
Mossurize	166	173	91	139	31.6	49.7
TETE, overall	1453	1490	1422	1518	52.8	52.4
Angonia	361	380	254	275	36.9	37.8
Chifunde	59	61	55	64	46.3	52.7
Tsangano	155	163	124	122	41.3	38.5
Changara	157	163	196	228	65.6	72.0
Total	**3657**	**3751**	**3826**	**4286**	**56.2**	**59.1**

Source: GoM. Economic and Social Plan (PES), 2007

Evaluation Question 9. What has been the effect on the percentage of the population that use an improved water source?

The sample indicates that the percentage of households in the population using improved water sources for drinking water has increased from 16% in 2008 to 28% in 2010. While part of this increase is autonomous, most is due to water point interventions under the One Million Initiative. In the sample these interventions cause a 32 percentage point increase for improved water sources and a 16 percentage point increase for CATS hygiene awareness training in the number of households taking drinking water from improved sources. Water point interventions are well targeted: they are placed in locations where many households still use unsafe water sources.

The number of households using improved water sources as their main source of drinking water has increased between the two survey rounds, as evidenced in Table 16 below. In the sample the percentage of households increased from 14.6% to 42%. This large increase partly reflects oversampling of treatment locations. Progress in the general population can be estimated from the INE sub-sample and is much more modest, but still considerable, from 16% to 28%.

Table 16 Percentage of households using improved water sources as their main source of drinking water		
	Percentage of households in the sample	Percentage of households in the population
2008	14.6%	16.3%
2010	42.0%	28.0%

Source: Household survey. The population average is based on the INE sub-sample using household weights

Obviously, households can switch to an improved water sources only if they have access to one. Switching to an improved source requires access to such a source, but also the willingness of households to make the change. According to Table 17 many households do make the switch when new improved water sources are introduced in their communities, but not all. The first row of the Table shows that 31% of the households (204+5+18 out of 740=620+60+60) in the communities with a water point intervention (new or rehabilitated water points) do not switch to using an improved source. There are also a few households (2%) switching to unimproved sources, possibly because of problems with the water point or conflicts in the community.[16]

Table 17 Households response to water point intervention (number of households)						
Main source used for drinking water			Water point interventions			
2008	2010	Total	No	2008	2009	2008 and 2009
Unimproved	Unimproved	889	662	204	5	18
Unimproved	Improved	477	100	284	55	38
Improved	Unimproved	39	20	19	0	0
Improved	Improved	195	78	113	0	4
Total number of households		**1600**	**860**	**620**	**60**	**60**

Source: Household survey and programme data on interventions

The regression reported in Table 18 shows whether the introduction of a new improved water source induces households to use it as their main source of drinking water. According to the Table the share of sample households using improved sources increased 27.7 percentage points. This large increase partly results from an autonomous trend (7.2 points) but mainly from the water point and CATS interventions. This implies that more than 20 of the 27.7 point increase in the use of improved sources can be attributed to activities under the One Million Initiative. A water point created under the One Million Initiative increases the percentage of households using improved sources of drinking water by 32 percentage points. The regression testifies to the success of water point interventions of the One Million Initiative: the explanatory variable "Water point intervention" only considers water points created under the One Million Initiative. The 32 point impact not only shows that

[16] The high number of improved water source users in 2008 in the communities where the intervention was carried out in 2008 is explained by the fact that many of these interventions occurred prior to the baseline.

people switch to improved sources if they can, but also that the placement of the interventions has been well targeted: for instance, if a new improved water point would be introduced in a community where already 100% of the households are using improved water sources, then that community would have zero switches and contribute nothing (indeed discount) the value of the coefficient. This favourable targeting of interventions was already mentioned above when discussing the sample.

According to Table 18 another important determinant of switching to a safer water source is the CATS intervention (see Section 3.2). This is a confrontational method to enhance hygiene awareness and sanitary practices. Although the coefficient is not significant at the conventional level of 5%, the size of the coefficient (a 16 percentage point increase) suggests that the CATS intervention might be important in inducing people to switch to improved water sources.

The robustness of the regression reported in Table 18 has been investigated by carrying out a number of similar regressions (not reported here) using different sets of households and adding potential confounders such as changes in wealth.[17] These variations do not change the basic result but some findings are worth reporting. If the regression is carried out only for communities that already had a functioning improved water source according to the baseline survey, a water point intervention does not have a significant impact on switching to an improved water source, however the sanitation intervention (CATS) does increase the probability of a household switching to an improved water source by 30 percentage points. On the other hand, if there was no functioning improved water source in the community at baseline, the water point intervention induces 42% of the households in these communities to start using the new improved source, whereas the impact of CATS is not significant in this case. Two other variables that play a role in the decision to switch to an improved water source are distance and perceived water quality. This is further discussed under Evaluation Questions 10 and 12 below.

Table 18 Change in use of improved water sources caused by change in availability of improved water sources and / or CATS intervention

Mean value dependent variable: 0.277				
	Estimate	Clustered Standard Errors	t-value	Pr(>|t|)
(Trend)	0.072	0.043	1.68	0.094
Water point intervention in location = 1, otherwise = 0.	0.318	0.089	3.57	0.000
CATS intervention in location = 1, otherwise = 0	0.159	0.093	1.71	0.087

Source: Data from household survey and programme data on interventions. The dependent variable is equal to 1 if a household switches from unsafe to improved water sources, -1 for a switch from safe to unsafe sources, and 0 if the source type has not changed. N = 1310. Only households interviewed in both survey rounds have been included. Adjusted R-squared: 0.170

17 The regression in Table 18 is a 'double difference' regression and therefore relatively insensitive to confounders that change only slowly over time. See the discussion in Section 4.2.

Evaluation Question 10. Have there been barriers to the access to the improved water source? If so, which proportion of households in the sample communities do not have access and why?

> *In 2010 58% of the sample households were still using unimproved water sources. Access to improved water is mainly determined by availability of improved water sources in the community and, within communities, by distance to the source. An increase of one kilometre in the distance to the improved source reduces the probability that a household uses it by 16 percentage points. User charges do not seem to act as a barrier against using improved water sources. There is no indication that other barriers exist to using safe drinking water, for example by excluding female headed households or poorer households.*

In the sample, there is no indication that female headed households or households in the lower wealth quartiles were in a disadvantageous position in terms of using improved water sources. Other factors which may determine whether a household actually uses an available improved source are user cost and the distance to the source. These are considered in turn.

User Cost

Both the household and the water point surveys have information on user costs. Table 19 summarises survey findings on user charges for locations with improved water sources. According to the Table, if user costs are charged at all, a monthly fee is the most common arrangement. In 2008 88% of the households in the sample reported that they did not pay at all for water. In 2010 this percentage was still as high as 63%. One reason for not paying may be that collection and payment systems are not universally present and/or efficient in all communities with improved supplies. As Table 19 documents, charging for improved water has become more common as the number of improved water points has increased.

Table 19 Payment mode for user charges for improved water sources

	2008	2010
No payment	19	17
Per month	16	55
Per bucket	2	4
Per breakdown	3	5
Other	2	5
Total number of improved water points	42 (in 29 locations)	86 (in 54 locations)

Source: Water point surveys 2008, 2010

For water points with user charges the mean and median monthly payment are given in Table 20. These numbers are in line with user charges reported in the household survey, as evidenced in Table 21.

Table 20 Monthly payment according to water committee		
Amount of monthly payment, (MZN prices 2010)	**2008**	**2010**
Mean payment	7.6	8.8
Median payment	5.7	10.0
Number of water points	17	55

Source: Water Point Questionnaire
In 2010 100 MZN = EUR 2.29 according to the exchange rate. Accounting for purchasing power differences the conversion is approximately 100 MZN = EUR 10

Table 21 User charges		
Mean payment per month (calculated, MZN prices 2010)	**2008**	**2010**
All HHs using any source*	0.7	3.7
Repeated HHs using improved source in 2010	1.6	10.4
Locations with any water point intervention	1.1	7.8
Locations with no water point intervention*	0.4	1.2

** payment per bucket excluded*
Source: Household survey

From the water point questionnaire it is not clear how refusals to pay are dealt with: this question was answered at only a few water points. Those that did answer indicated that people can still get water even if they do not pay, irrespective of whether they are unable or unwilling to pay. Most paying households when asked about their opinion of water cost find user charges reasonable or cheap (70% in 2008, 81% in 2010).

The possibility that user charges are too high for some households, cannot be excluded, but it looks very unlikely. For example in a 'cross-section' regression using survey data from 2010 there is no evidence that locations with higher user charges have a lower percentage of households using water from the improved source. These results suggest that the introduction of user charges together with new improved water sources has not created major barriers to using them. This finding is further confirmed below.

Distance

Distance appears to be a more important barrier to using improved water sources than user charges. This is illustrated in the regression reported in Table 22, linking the use of safe drinking water to distance from a safe drinking water source.[18] The regression uses only data from the second survey round, when the data included a reasonable number of locations

[18] Distance is measured here as the distance "as the crow flies" between the household and the location of the nearest improved source, using the GPS measurements. Households were asked about the "distance to the water point[s]" they use, not the distance to the nearest improved water point. Self-reported distance could therefore not be used in the regression of Table 21.

with improved water sources.[19] Judging by the high p-values, wealth and household size do not play a role in the decision to use safe drinking water sources. Education clearly does play a positive role: households with educated adults (i.e. above 15 year old and having had some schooling) are 6.7 percentage points more likely to use drinking water from improved sources. Note that this is not the effect of such households living in more favourable locations, since these and similar effects are captured by the location fixed effects. Distance clearly has a very strong negative impact on using safe drinking water: living 1 km further from a safe source reduces the probability of using it by 18.3 percentage points.

Table 22 Determinants of using improved sources of drinking water

Mean value dependent variable: 0.56				
	Estimate	Standard Errors	t-value	Pr(>|t|)
(Intercept)	0.384	0.094	4.061	0.000
Wealth indicator	-0.001	0.018	-0.083	0.934
Educated adult in household = 1	0.067	0.026	2.592	0.010
Distance to nearest improved water point (km)	-0.183	0.023	-7.821	0.000
Household size	-0.000	0.004	-0.041	0.967
Location fixed effects	(not reported; jointly significant)			

Source: Data from household survey and programme data on interventions, 2010 round. Cases with impossible values for distance and user cost have been omitted. The dependent variable is equal to 1 if a household uses drinking water from an improved source, 0 otherwise.
Number of households 1105
Adjusted R-squared: 0.59 (0.56 explained by location fixed effects)

Evaluation Question 11. Is the improved water point the only water source for domestic use? If not which other (improved and non-improved) sources are used, when and by how much are these used and for what purposes?

The vast majority of households use the same source of water for all domestic purposes. When households resort to a different source of water it is normally for washing and bathing.

Despite the programme's success reported in the discussion of evaluation question 9 above, 33% of the households continued to use unimproved sources in villages where an improved water source was introduced (see Table 17). Water from improved sources is not only used for drinking: 95% of households reported that they use it for cooking, 91% for washing hands, 89% for washing kitchen utensils, 84% for bathing, 66% for laundry. There is also some use of improved water sources for *non*-domestic use: 30% of households report using the water also for small animals, 4% for large animals, 0.3% for irrigation and 5% for

[19] Since double differencing is not possible for a regression using only data from one survey round the regression in Table 22 uses a less powerful technique, 'location fixed effects', to minimise confounding by omitted variables.

construction. Hence, the vast majority of households use water from improved sources only for domestic purposes.

5% of all sample households and 11% of the households using an improved primary water source resort to secondary water sources. These are almost exclusively traditional. 10% of these households use the unsafe secondary water source for drinking. Most of the households use the water for bathing (96%), washing hands (35%) and washing kitchen utensils (79%) and laundry (37%). 17% of the households report that they use this water for irrigation, 13% for animals.

Evaluation Question 12. What has been the effect on the microbiological and chemical quality of drinking water (at source and point of use)?

A disturbing finding is that improved water sources are not always safe: in 2010 19% of the samples from improved sources were contaminated by coliform bacteria. Less surprisingly, of the unprotected sources 90% were unsafe in 2010. Households are not good at judging the quality of water at the source. Since there is evidence that the decision of a household to switch to an improved source depends on the household's assessment of its quality there is a strong case for disseminating reliable information on water quality.

A positive finding is that when households switch to an uncontaminated water source this substantially increases the probability (by 48 percentage points) that the water is also clean at the point of use. However, water quality at the point of use is much lower than at the source. This is a common finding in evaluations of water interventions.

Water quality was tested both at source and at the point of use, in the house. The aim was to take a number of water samples from two households in every location, each set consisting of samples from the point of use and from the actual source used by the household. However, this aim could not be fully achieved, especially not in the first survey round. In 2008 samples were taken from 37 households in 20 locations of the PEC sub-sample, and from 42 households in 22 locations in the INE sub-sample. For 2010 the original aim was almost met: 74 households from 38 locations in the PEC sub-sample and 73 households from 38 locations in the INE sub-sample. For 47 households there are water samples in both survey rounds, 16 from 12 clusters in the PEC sub-sample, and 31 from 18 clusters in the INE sub-sample.

Water quality at the source

In the locations without interventions microbiological water quality at the source often deteriorated: faecal *coliforms* were found in 2010 where none were found in 2008. In 85% of those locations water was found to be contaminated in 2010 (Table 23). Of the locations for which water quality was measured both in 2008 and in 2010, 65% had contaminated water in 2010 but not in 2008. The reason for this serious deterioration is not clear. It might reflect breakdown of maintenance or a change in the way contamination was measured.

Table 23 Changes in Water Quality at Source (% of locations with or without water interventions)			
2008	**2010**	**locations without water intervention (% and number)**	**locations with water intervention (% and number)**
clean	clean	11.5% (3)	57.1 (12)
clean	contaminated	65.4% (17)	14.3 (3)
contaminated	clean	3.8% (1)	9.5 (2)
contaminated	contaminated	19.2% (5)	19.0 (4)
total		**100.0 (n = 26)**	**100.0 (n = 21)**

Source: Water point survey and programme data on interventions

In locations with water interventions about two thirds of the samples were uncontaminated in 2010. (These samples were taken at the source actually used by the sampled households; they are not necessarily the improved water sources in existence in the location.) This does not necessarily mean that only about two thirds of the improved water sources are "clean" but rather that households do not always switch to the improved water source. Nevertheless and unfortunately, not all improved water sources are clean. As shown in Table 24 about 19% of those sources were contaminated. This clearly is a very worrying finding.[20]

Table 24 CFU Count at Source (2010)			
CFU count	**Water source**		
	Overall (%)	**Unimproved (%)**	**Improved (%)**
0	36.9	3.5	81.3
1-10	6.0	5.9	6.3
10+	57.0	90.6	12.5
Number of samples	149	85	64

Source: Water point survey 2010

In addition to these objective measurements on water quality based on biological tests the survey collected subjective data on the households' own assessment of water quality. It turns out that this assessment is not very accurate. According to Table 25 households are particularly bad at detecting unsafe water.

[20] The water point questionnaire includes a 15 point check list of possible technical and environmental conditions that could explain water contamination (water point survey, section D). However, for improved water sources the correlation between these conditions and contamination is at best extremely weak: they cannot explain the finding that 20% of improved water sources are contaminated.

Table 25 Water quality: subjective and objective 2010		
	Water sample CFU count = 0	Water sample CFU count > 0
Water is 'good' or 'very good' according to household	52	45
Water is 'reasonable' or worse according to household	3	49

Source: Household and water point surveys, 2010

This finding is important because households are less likely to switch to improved water sources if they judge the quality of their current source to be good or very good. The evidence for this is the regression in Table 26. According to the Table a household is 25.1 percentage points less likely to switch to an improved source if the original water quality in 2008 (before a possible intervention) is perceived as 'good' or 'very good'.

The discussion of evaluation question 13 below will also show that perceived water quality is an important determinant of the quantities of water consumed. Together with Table 25 and Table 26 this suggests that it is important to provide accurate information on water quality. Obviously, a household is not going to switch unless an improved source has become available, but Table 23 and Table 26 show that this is not enough. In addition, the household must become convinced that water quality from the new source is better. Unfortunately, this is not as trivial as it sounds: as was found above, newly created improved sources may well be contaminated. This implies that the new source in itself is not a clear signal for the households' switching decision.

Table 26 Perceived water quality determines switch to improved sources				
Mean value dependent variable: 0.36				
	Estimate	Clustered Standard Errors	t-value	Pr(>|t|)
(Intercept)	0.360	0.102	3.52	0.000
Household considered water quality as (very) good in 2008 = 1	-0.251	0.056	-4.45	0.000
Water intervention = 1	0.228	0.102	2.23	0.026
CATS interventions = 1	0.153	0.095	1.61	0.108
Wealth indicator 2010	-0.040	0.034	-1.18	0.236
Educated adult in household in 2010 = 1	-0.027	0.046	-0.60	0.549
Household size in 2010	0.012	0.008	1.15	0.146
Distance to improved source in 2010 (km)	-0.096	0.035	-2.73	0.006

Source: Data from household survey and programme data on interventions. Cases with impossible values for distance have been omitted. The dependent variable equal to -1,0,1 if a household switches from safe to unsafe type, does not change type, or switches from unsafe to safe drinking water, respectively.
Number of observations is 1129. Adjusted R-squared is 0.20

Water quality at the point of use

Many studies find that fetching water from a safe source does not guarantee that the water is still safe when and where it is used. This is also the case in Mozambique. In 2008, 80 test samples were taken from household points of use, of which 40 appeared to be microbiologically contaminated. Of the 40 contaminated samples, 11 had been fetched from improved sources, or 28%. In 2010 148 samples were taken at the point of use for which 128 were contaminated and 20 clean. Of the 128 contaminated samples, 36 had been fetched from improved sources, again 28%. Comparing microbiological contamination at source and point of use across all samples, it is found that in 2008 36.7% of the source samples were contaminated against 49.4% of the point of use samples. In 2010 63.3% of the source samples were contaminated, while 86.4% of the point of use samples was unsafe. There is thus widespread contamination between source and point of use.

In this context the evidence reported in the regression analysis of Table 27 is encouraging. It shows that when households switch to uncontaminated water source this reduces the probability that the water is contaminated at the point of use very substantially: by 54.8 percentage points. This is an important finding because many studies have pointed to contamination between source and point of use to explain why health effects of access to improved sources is less than expected. For instance, the World Bank's Independent Evaluation Group (IEG, 2008) stresses the importance of (amongst others) treatment at point of use rather than the source. Yet, Table 27 shows the importance of water safety at the source for safety at the point of use, at least in the context of the One Million Initiative.

The Table also contains a disturbing finding on cleaning containers: the effect of using soap for cleaning the containers seems to have a strong (29.7 points) and significant negative effect on water quality at the point of use. This surprising finding warrants further research.

Table 27 Water safety at point of use

Dependent variable: change in water safety at point of use = -1 (deterioration), 0, or 1 (improvement). Mean of dependent variable is -0.42.				
	Estimate	Clustered Standard Errors	t-value	Pr(>|t|)
(Intercept)	-0.265	0.107	-2.466	0.018
CATS intervention in community = 1	-0.167	0.134	-1.242	0.221
Change in water quality at source (+1 is achieving coliform-free status, -1 losing coliform-free status, 0 otherwise)	0.477	0.115	4.155	0.000
Started to use same container for fetching and storing water = 1, started to use different containers = -1, otherwise 0	0.213	0.098	2.168	0.036
Started to use soap to wash containers = 1, etc.	-0.277	0.079	-3.501	0.001
Started to treat water = 1, etc.	-0.091	0.172	-0.530	0.599

Source: Household and water point surveys, and programme data on interventions. N = 47 (households who's water has been tested in both survey rounds). Adjusted R-squared is 0.847

Sanitary inspection of improved water points

Table 23 indicates that about 19% of the improved water sources are in fact contaminated. This could reflect the condition of the water point and its surroundings. According to the sanitary inspection component of the water point questionnaire 32% of the boreholes have a source of contamination at less than 30 meters (8% latrines, 26% other) and around two-third of them have rubbish spread up to 30 meters from the water point (49%) and/or there are signs of animals approaching up to 10 meters from the water point (53%). Considering the condition of the boreholes, 30% of them have stagnant water at less than 2 meters from the water point due to deficient drainage, There are cracks in the cement floor or the drainage in 24% of the boreholes, 50% of them have a too small base (less than 2 meters), and 32% of them are considered unhygienic due to the presence of faeces, kitchen rubbish or stagnant water. These findings apply to all improved sources, including those of the One Million Initiative. Clearly the Initiative should therefore in future pay more attention to ensure that communities take better care of their boreholes.

Evaluation Question 13. What has been the effect on the amount of water used per day per person for domestic purposes (total and from an improved water source)?

Overall, the consumption of domestic water is low and has declined between 2008 and 2010 from 12.6 to 10.2 litres/person/day. However, households tend to increase water consumption when they perceive an improvement of the water quality.

The survey indicates a mean domestic water use of 10.2 litres per day per person, which is a decrease of 2.4 litres per day in the consumption of domestic water per capita both in intervention and non-intervention locations. Table 28 summarises the data by intervention types.

Table 28 Trends in water consumption

Mean consumption of litres per day per person	All	No intervention	Water intervention only	CATS intervention only	Both water and CATS interventions
2008	12.6	12.3	12.8	13.0	12.9
2010	10.2	9.6	10.0	11.0	11.0
Change	-2.4	-2.7	-2.8	-2.0	-1.9
Locations affected	80	36	15	7	22

Source: Household survey and intervention history from UNICEF

In 2010, the households used only about half of the recommended 20 litres per person per day for the use of domestic purposes.[21] Only 14% of the households in the sample consume more than 20 l/p/d. This number is similar across users of improved or unimproved water

[21] The recommended 20 litres per person per day include 5 l/p/d drinking water and 15 l/p/d for reducing water washed diseases and practicing good sanitation and hygiene. See Howard and Bartram (2003).

sources and the different intervention categories. This still leaves two possibilities. First, it may be that while households take home only about 10 l/p/d they actually *use* more, the difference being water used at the water point, e.g. for washing and cleaning purposes. The second possibility is that households' water use is in fact too low. Unfortunately it is not possible to distinguish these two cases with the survey data. (While the question on water use is standard in water research it would be advisable to refine the instrument so that the distinction between use *in situ* and use at home can be made.) The household questionnaire asks about the source of drinking water. However, as indicated under evaluation question 11 above, the water is not only used for drinking.[22] It is also not possible to say whether households voluntarily fetch relatively little water or whether their use is rationed, e.g. because of the high number of users and the capacity of the well.

The quantity of water taken home has therefore not increased but has fallen between 2008 and 2010. The only encouraging sign here is that where (self-reported) quality has improved this has led to an increase (Table 29). This effect is strong and significant: an improvement of one step on a 5 point scale of perceived quality increases daily consumption of water by 0.7 litre per person. Other likely factors such as the switch to an improved (or other) source or the distance to improved water sources are not significant. As mentioned before, this further underlines the potential importance of providing accurate information on water quality.

Table 29 Water consumption and perceived water quality

Dependent variable: changes in drinking water consumption (litres per person per day)				
	Estimate	Clustered Standard Errors	t-value	Pr(>|t|)
Change in perceived quality (5 point scale)	0.671	0.235	2.854	0.004
Change in improved / unimproved status of drinking water source (+1 = favourable, etc.)	0.332	0.784	0.424	0.672
Change in distance to improved source (km)	0.001	0.001	0.939	0.348
Switch to other source = 1	-0.719	0.968	-0.743	0.458

Source: Household survey, repeated households, excluding top and bottom percentile of sample. N = 1227. Regression controls for location fixed effects (not reported here).
Adjusted R-squared: 0.24

Evaluation Question 17. What has been the effect on time use for collection of water, and for which household members?

The sample data suggest a massive decrease in water collection time in all categories that cannot be explained. These data do not seem to be sufficiently reliable to answer this question.

[22] The 64 households that report that they only use the water source for drinking consume 8 l/p/d. This suggests that household fetch enough water for drinking.

According to Table 30 the time spent fetching water has fallen considerably. For example, the median time spent fetching water in villages with *no* intervention fell dramatically, from 90 to 30 minutes per day. These changes are not credible since there is no clear reason why water collection time should have decreased so strongly.

Table 30 Water collection time

Median number of minutes spent on fetching water per day	Overall	No Water Intervention	Water Intervention
2008 round	90	90	80
2010 round	30	30	30
Change	-60	-60	-50

Source: Household survey and programme data on interventions

Evaluation Question 18. In what way have time savings been used (for domestic work, field work, income earning, schooling, etc.)? Who are the primary beneficiaries?

As indicated in the answer to the previous question, the time savings reported by households are not credible. From the community questionnaire there is some evidence that the new water points have led to more time for 'other economic activities' and that more children go to school.

In the community survey representatives from 18 out of 77 communities indicated that the new water points have led to 'other economic activities' (not further specified), while 11 mentioned that more children go to school. However, below (evaluation question 25) it is argued that the increase in enrolment is mostly an autonomous trend, unrelated to the water interventions.

Evaluation Question 19. Is the water from the improved water source used for other purposes, besides domestic purposes? If so, for which purposes and by whom?

Almost all households use the same source of water for drinking and other purposes. About 30% of the households use water from improved sources for non-domestic purposes, mostly for small animals and construction. In this respect there is not much difference between households using or not using safe sources of drinking water.

The non-domestic uses include irrigation, water for animals and construction. The demand for water for non-drinking purposes could put considerable strain on available water sources, including the newly created improved water facilities. This issue cannot be addressed on the basis of available survey information and should therefore be included in the third and final round of data collection. See also the discussion of Evaluation Question 11.

4.4 Sanitation and hygiene - related interventions of the One Million Initiative

Evaluation Question 14. What has been the effect on the access and use of improved sanitary facilities (for men, women and children)?

There has been a large increase in the ownership and use of latrines over this period and most of this can be attributed to the CATS intervention. This positive finding is remarkable in view of the generally disappointing findings in other countries on the effectiveness of sanitation and hygiene awareness promotion programmes. However, most of the latrines still do not satisfy the conditions for improved sanitation.

Latrine ownership

Table 31 Latrine Ownership and CATS intervention

	Latrine ownership in locations without CATS intervention (%)	Latrine ownership in locations with CATS intervention (%)	Latrine ownership in all locations (%)
2008	45.4	41.2	43.9
2010	50.7	62.2	54.9
Change	5.3	21.0	11.0

Source: Household survey and programme data on interventions

Recall from Chapter 3 that the programme included two sanitation awareness and training activities: PHAST and the CATS programme which was added later.[23] PHAST is a relatively standard form of training using participatory techniques but CATS (pioneered in Bangladesh) is innovative in using confrontational methods to convince households of the importance of behavioural changes. As Table 31 shows latrine ownership increased substantially in the sample between 2008 and 2010, from 44% to 55%. The Table also shows that the increase was much larger for locations where households received CATS intervention.

Access to latrines can also be achieved by sharing them between households. This is relatively uncommon in Mozambique: in 2008 only 10% of households reported that they were sharing latrines with other families; in 2010 shared latrines were used by 11% of households. Increased access to latrines is therefore mainly achieved by an increase in the number of privately owned latrines.

[23] It is not possible to evaluate the PHAST programme using the household survey as it was already running at the time of the baseline survey.

The CATS intervention is specifically aimed at reducing the practice of open defecation. In Table 32 the survey evidence on open defecation is presented. Again, there was an overall decline (except for the category of "other children") but the effect was much more pronounced for households in the communities with CATS intervention. As a result, in 2010 36% of the sample population was still practicing open defecation (50% in case of other children). In the CATS intervention communities this number was somewhat lower at 31% (45% for other children).

Table 32 Open Defecation Practice and CATS intervention (changes 2008-2010. % points)

	Open defecation in locations without CATS intervention (%)	Open defecation in locations with CATS intervention (%)	Open defecation in all locations (%)
Men	-7.5	-20.9	-12.3
Women	-7.7	-21.4	-12.7
school children	-5.4	-27.1	-13.2
other children	+8.2	-3.9	+3.8

Source: Household survey and programme data on interventions

It is tempting to interpret these results as causal effects of CATS, but, of course, they might simply reflect the non-random allocation of the CATS intervention over locations. Indeed, the results of Table 32 suggest that the CATS intervention was targeted, quite sensibly, at communities where open defecation was more prevalent prior to the intervention. To overcome the problem of non-random allocation, in Table 33 the data are used in a double difference regression to investigate the impact of CATS intervention on latrine ownership. The analysis confirms that the effect is large: training raises the probability that a household has access to a private latrine by 13.6 percentage points. As discussed in Section 4.2 the method of double differencing eliminates most of the effect of observed and unobserved differences between households. This makes a causal interpretation of the estimate much more credible.

Latrine with handwashing facility

Latrine ownership also increased substantially in locations not reached by the CATS intervention. This is reflected in the trend term which suggests an autonomous increase of 6.9 percentage points. Similarly, the probability increases as households become less poor.[24] This effect too is quite large and highly significant. Note that households whose wealth increased between 2008 and 2010 were also more likely to acquire a latrine, suggesting that the cost of building a latrine plays a role as well.

Table 33 Effect of CATS intervention on latrine ownership

Dependent variable: change in having a latrine at the house or on the compound				
Mean dependent variable	0.105			
	Estimate	**Clustered Standard errors**	**t-value**	**Pr(>|t|)**
Trend	0.069	0.020	3.531	0.000
Received CATS intervention in 2008 or 2009	0.136	0.052	2.591	0.010
Increase in household size	0.008	0.005	1.815	0.070
change in wealth	0.105	0.024	4.338	0.000

Source: Household survey and programme data on interventions. N = 1310 (households included in both rounds)
Adjusted R-squared: 0.0394

[24] Households that lost their latrine saw a significant decline in their wealth, as well. Note that association is descriptive, not causal. However, it hints at the importance of resources for sustaining the ownership of latrine.

Latrine use

Not surprisingly, but crucially, owning a latrine results in using it as well as shown in Table 34. The results indicate that almost all adults use the latrine if the household owns one (93-98%) but children, especially if not enrolled in school, are lagging behind. Regression results (not reported) show that owning a latrine increases the probability of using it by 75.1 percentage points. Given ownership the additional effect of the CATS intervention is minimal. The CATS intervention therefore is effective almost entirely through the promotion of latrine ownership: once a household owns a latrine the additional effect of the CATS intervention is minimal.

Table 34 Latrine use and ownership (% of sample using a latrine)

	Household owns latrine in 2008	Household owns latrine in 2010	Household does not own latrine in 2008	Household does not own latrine in 2010
Men	95.6	93.6	6.0	9.6
Women	97.2	98.1	6.2	10.7
School children	65.8	69.2	3.9	6.0
Other children	65.5	45.0	4.2	4.3

Source: Household survey

The result on the CATS effect on approach to latrine ownership and use is remarkable for two reasons. First, a typical finding in similar evaluations studies (including earlier IOB evaluations in Tanzania, Yemen, and Egypt) is that hygiene and sanitation training do not have much effect, if any. The One Million Initiative seems a favourable outlier in this respect. It would seem likely that the difference is due to the confrontational nature of the CATS approach which is quite different from the traditional PHAST training programme promoted by the WHO.[25] However, this could be a short-term effect. Whether the increased ownership and use of latrines is sustainable over a longer period remains to be seen.

Improved sanitary facilities

The above results document the advances in latrine ownership and use in the sample communities. However, it is equally relevant whether these latrines satisfy the conditions required to effectively break the disease transmission of the 6 Fs.[26] In Mozambique, traditional improved latrines have been included in the national sanitation strategy to acknowledge the use of local materials to build latrines that fulfill the effective and safe separation of feces from human contact. However, this category has been difficult in terms of compatibility with national surveys (both for self-response and for observations). To achieve sustainable benefits to sanitation, Mozambique opted in 2010 for the use of *safe sanitation* concept. The concept of *safe sanitation* comprises of a durable slab (can be any local

[25] For a discussion of the PHAST approach see WHO (2011).
[26] The 6 Fs are faeces, flies, fluids (water), fields, food and fingers.

material), lid that properly closes the hole, superstructure that provides privacy, and the presence of a handwashing facility with soap or ash.

In the household survey enumerators inspected the latrines used by households to check whether they satisfy the conditions of safe sanitation. Table 35 summarises the findings of the inspection. Communities with CATS intervention have a higher proportion of households with latrines (62 rather than 55%). In addition, the households at these locations are more likely to have a handwashing facility and a latrine with a lid. However, households in CATS communities have a lower share of with a "safe-hole". Moreover, few latrines satisfy all the conditions of adequate sanitation (2.9 and 3.9%), and even fewer qualify for safe sanitation.[27] In 2010 there were only 18 households using an improved latrine with a cement slab.

Table 35 Improved latrines and safe sanitation

	Number households	Percentage of households	Number of households in locations with CATS intervention	Percentage of households in locations with CATS intervention
Household owns a latrine	878	54.9	361	62.2
Components of improved sanitation	**Number of latrines**	**Percentage of latrines**	**Number of latrines in locations with CATS intervention**	**Percentage of latrines in locations with CATS intervention**
Latrine has a cement slab	16	1.8	3	0.8
Latrine has a safe hole	456	52.4	160	44.9
Latrine has a roof	284	32.6	119	33.4
Latrine has a lid	248	28.6	117	32.9
Latrine has safe hole + roof	153	17.6	56	15.7
Latrine has safe hole + roof + lid	29	3.3	16	4.5
Components of safe sanitation				
Privacy	572	65.7	219	61.5
Handwashing facility at household	325	37.0	154	42.7
Handwashing facility has soap/ash	157	17.9	75	20.8
Handwashing facility close to latrine	162	18.5	90	24.9
Latrine has safe hole + roof + handwashing facility with soap/ash	16	1.8	8	2.2

[27] There does not appear to be a difference with respect to adequate and safe sanitation among the households owning a latrine already in 2008 and the ones acquiring a latrine since the baseline survey. In that respect the CATS intervention does not appear to have an impact.

Components of safe sanitation				
Latrine safe hole + roof + proper lid + handwashing facility	7	0.8	5	1.4
Latrine safe hole + roof + proper lid + handwashing facility with soap/ ash	6	0.7	5	1.4

Source: Household survey (observations of enumerators) and programme data on interventions

Table 36 reports on the sustainability of the latrines with respect to the material of the wall and the condition of the latrine building in 2010. Only 6% of the latrines have cement or burnt block walls, but 44% have clay blocks. Most of them are in good or reasonable condition and only 5% of them are in a bad state. The UNICEF Mozambique commissioned sustainability check in 2009 indicated that many latrines have been rebuilt after the rainy season. Unfortunately, using the household survey it is not possible to verify this finding.[28] However, data from the household survey indicate that 50% of the households with a latrine in 2010 changed the location or emptied the latrine at least once in the last 2 years, and 11% of them did so more than once. These figures are the same for households who had a latrine already in 2008.

Table 36 Material and condition of the latrine's walls in 2010 (percentage of latrines)

Material of latrine's walls	Condition is good	Condition is reasonable	Condition is bad	Total
Cement or burnt blocks	3.8	2.1	0.1	6.0
Clay blocks	26.4	16.3	0.9	43.7
Cane	6.1	16.9	1.6	24.6
Other (grass, sticks, plastic...)	11.7	11.6	2.4	25.7
Total	**48.0**	**46.9**	**5.1**	**100.0**

Source: Household survey (observations of enumerators)

Open defecation free communities

As part of the CATS intervention, communities could apply to be awarded open defecation free (ODF) status (recall Section 3.2). In the sample, 7 out of the 80 clusters became ODF communities.[29]

[28] In the final survey, a question on rebuilding latrines after the rainy season could be added to the household questionnaire to address this issue.

[29] The 7 ODF communities are located in only 3 districts: 3 in Angónia (Tete), 2 in Guro (Manica), 2 in Mwanza (Sofala).

The household and community surveys do not suggest clear factors that could predict a community's acquired ODF status. Households and community leaders were asked about the advantages and disadvantages of latrines, but there are no significant differences between the answers from ODF and non-ODF communities. One might expect that smaller communities more easily achieve ODF status, but there is no evidence that the CATS intervention works better in smaller communities in terms of ODF status and ownership of latrines. However, there is some indication that the share of households owning latrines was already somewhat higher in ODF communities compared to the district sample average at the time of the baseline survey, i.e. prior to the interventions of the One Million Initiative.[30] The survey also shows that the conditions for achieving ODF are not always applied very strictly: even in ODF communities some households report open defecation practices (7%), and interviewers observe latrines without lids (43%), and absence of handwashing facilities (58%).[31]

Evaluation Question 15. What has been the change in relevant hygiene awareness and practices (i.e. cleanliness of latrine; handwashing with soap or substitute at critical times; safe water storage; use of rack for cooking utensils; safe handling of baby excreta)?

Cleanliness of latrines has improved, especially in locations that received the CATS awareness intervention. Latrines are generally clean: in 2010 more than 94% were clean irrespective of whether or not there had been a programme intervention. Handwashing using soap or ash has become more common and there has been a general increase in the use of lids on containers for fetching and storing water. This increase is unrelated to programme interventions. About half of the households use racks for drying cooking utensils, especially in locations with water interventions. Around 85% of households dispose safely of baby excreta. This number has not changed between survey rounds. It is important to note that only very few households satisfy all conditions for reducing water borne diseases.

Cleanliness of the latrine

Enumerators were asked to assess the cleanliness of the latrines. In the questionnaire, "clean" is defined in terms of the presence of faeces or urine. Table 37 reports the findings for households owning a latrine in 2008. The results for 2010 are quite similar if also the new latrine owners are included. The Table suggests a general increase in cleanliness, which could of course reflect different standards applied by interviewers as much as a positive trend. Across the different intervention groups it appears that cleanliness has improved especially in locations with only the CATS intervention with a decline of 18.6 percentage points (from 20.8 to 2.2%) in the 'dirty' category. This underlines once again the effectiveness of the CATS awareness programme.

[30] The share of latrines (in the sample) in districts with sampled ODF communities varies widely between districts: Angónia 75%, Guro 29% and Mwanza 12%.

[31] These percentages refer to communities that achieved ODF status in 2008 and 2009.

Table 37 Cleanliness of latrines Percentage of households with a latrine on their compound					
Condition of latrine inside		**Interventions**			
2008	**Overall**	**None**	**Water only**	**CATS only**	**Water and CATS**
Very clean (%)	23.6	25.5	26.3	22.1	18.3
Clean (%)	66.8	66.6	65.3	54.4	73.4
Dirty (%)	8.6	6.7	8.5	22.1	7.1
Very dirty (%)	1.0	1.2	0.0	1.5	1.2
Number of latrines	702	345	118	69	170
2010					
Very clean (%)	35.4	31.0	37.4	39.3	41.2
Clean (%)	59.5	63.3	57.9	55.7	54.9
Dirty (%)	3.3	3.1	2.8	3.3	3.9
Very dirty (%)	1.8	2.7	1.9	1.6	0.0
Number of latrines	878	380	137	92	269
Change					
Very clean	11.9	5.4	11.1	17.3	22.8
Clean	-7.3	-3.3	-7.3	1.3	-18.5
Dirty	-5.4	-3.7	-5.7	-18.8	-3.2
Very dirty	0.8	1.5	1.9	0.2	-1.2
Overall change in cleanliness	4.6	2.1	3.8	18.6	4.4

Source: Household survey, including only households who owned a latrine in 2008

Handwashing at critical times

Table 38 summarises handwashing practices in 2010. The percentage of persons not washing their hands at critical times has not changed much between the two survey rounds. The very high values in the Table suggest over-reporting of handwashing, but the point here is that there is no difference between the two survey years.[32] There has been an increase in the use of soap or ash instead of water only for handwashing as shown in Table 39. These changes have been most prominent in locations with CATS interventions.[33] For instance, 7.3% more women use soap and ash with water to wash their hands before eating, but this is 12.5% for the women in locations that received CATS intervention. The change in using soap or ash is most prominent in the case of handwashing after defecation, more than 40% of the adults and 32% of the school children reported doing so in 2010.

[32] That handwashing is over-reported is also suggested by the fact that only 26% of the households had a handwashing facility at the household in 2010, according to the observations of the enumerators. See also Table 35.

[33] At the baseline, the percentage of households washing hands using soap or ash in the communities with CATS intervention was similar to the other communities.

Table 38 Handwashing practice in 2010 (percentage of persons responding)				
	Men	Women	School children	Other children
Before eating	100	100	100	98
After defecation	97	95	84	73
After disposing babies' faeces	-	90	72	56

Source: Household survey, 2010 round

Table 39 Handwashing with soap or ash (percentage of persons responding)				
2008	Men	Women	School children	Other children
Before eating	12.7	11.9	9.4	8.3
After defecation	20.1	18.8	14.1	11.2
After disposing of babies' faeces	--	18.6	11.7	6.7
2010				
Before eating	20.9	19.2	15.9	14.2
After defecation	43.6	40.3	32.2	23.2
After disposing of babies' faeces	--	34.1	24.3	16.9
Change				
Before eating	8.2	7.3	6.5	5.9
After defecation	23.5	21.5	18.1	12.0
After disposing of babies' faeces	--	15.5	12.6	10.2
Change in CATS communities				
Before eating	14.5	12.5	12.6	11.0
After defecation	29.3	25.6	24.3	16.7
After disposing of babies' faeces	--	19.7	18.1	18.6

Source: Household survey

Asked about reasons not to wash hands, most respondents mentioned lack of information (61%) and lack of habit (67%). These percentages do not differ much between the intervention groups.

Handwashing facility near latrine

Water handling

Households were asked whether they usually treat drinking water before drinking in general, and, in particular during the cholera season. The vast majority of households do not treat water, 86% in both survey years. The data suggest however that CATS intervention prompts more households to treat water: in 2010 20% of households in locations that only received CATS intervention treated their water, against only 2% in 2008.[34]

Table 40 reports on the use of lids on containers, both for fetching and storing water. The Table shows that for both purposes lids have become more common regardless of interventions.

[34] Households who do report treating water before drinking mostly use bleach/chlorine (77% in 2010) or boil water (21%). The 'treatment' "Allow to rest and settle" was fairly common in 2008 (practiced by 18% of households treating water), but was only used by 7.5% of such households in 2010.

Table 40 Water handling (percentage of household reporting)					
Containers for fetching water always have a lid		Interventions			
	Overall	No intervention	Water only	CATS only	Water and CATS
2008	66.4	63.3	64.1	60.3	74.9
2010	77.5	74.3	79.7	71.0	83.1
Change	11.0	11.0	15.7	10.7	8.2
Containers for water storage have a lid					
2008	83.5	80.3	81.4	79.1	91.5
2010	91.8	87.5	94.7	90.0	97.3
Change	8.2	7.2	13.3	10.9	5.8

Source: Household survey and programme data on interventions

Using racks for utensils

During the household survey enumerators noted which households use racks for drying cooking utensils. The use of racks for drying cooking utensils among survey households increased from 35.1% of households in 2008 to 40.5% in 2010. Racks are most common and the increased use is most prominent in locations with water interventions, in particular when in combination with CATS intervention: in 2010 54.4% of households in locations with water and CATS interventions owned a rack for cooking utensils.

Handling baby excreta

Households were asked how excreta from children under 3 years of age were handled the last time. The results are summarised below in Table 41. Generally it is considered safe to dispose of baby excreta in a latrine or to bury them. The percentages of safe disposal are generally high and have not changed much between the two survey rounds, nor do there seem to be major differences between intervention groups.

Table 41 Handling of baby excreta (percentage of households reporting)					
	Overall	Interventions			
		No Intervention	Water only	CATS only	Water and CATS
Safe disposal 2008	85.4	84.3	83.8	73.6	91.2
Safe disposal 2010	84.9	83.1	84.3	73.2	91.3
Change 2008 – 2010	-0.5	-1.2	0.5	-0.4	0.1

Source: Household survey and programme data on interventions

Rack for utensils

Conditions for reducing water related diseases

Table 42 summarises the percentage of households that meet certain conditions to reduce water related diseases. These include sufficient water use for hygiene (domestic water use of at least 20 l/p/d), good practice sanitation and hygiene (ownership of latrines, household members abandoning open defecation and households with babies safely disposing of their faeces), and the presence of a handwashing facility with water and soap or ash. The Table shows that only a tiny minority of households satisfy all the conditions to reduce water related diseases.

Table 42 Households satisfying the conditions to reduce water related diseases in 2010

	Number of households	Percentage
Water use of 20 l/p/d or more	219	13.7
Own a latrine	722	54.9
Nobody is practicing open defecation (ODF)	765	47.8
Safe disposal of baby's feces	594	81.7
Handwashing facility	414	25.9
Water present at household	355	85.5
Soap/ash present at household	188	45.3
Sufficient water use + ODF	103	6.4
ODF + handwashing facility	282	17.6
ODF + handwashing facility + water + soap	114	7.1
Water + ODF + handwashing + water +soap	16	1.0

Source: Household survey

4.5 Health impact of the One Million Initiative

Evaluation Question 16. What has been the effect of the interventions on the health of the target population (in terms of DALYs reduction[35])?

> *There has been a general decline in the prevalence of water related diseases in the sample, from 30% to 14% by the measure used in this section, based on a six month recall indicator. The analysis demonstrates that a significant part (18%) of this decline is due to the sanitation interventions. These are responsible for a 3 percentage point decline in the sample. This estimate is statistically significant and constitutes clear evidence of the effectiveness of the programme. The analysis finds no significant health effect of the water interventions at the household level. However, the data suggest a significant and favourable health effect of the water interventions for children under five years of age.*
> *The indicator used is likely to severely underestimate the prevalence water related diseases. The data therefore do not allow a credible translation of the decline in disease burden in terms of DALYs.*

This is perhaps the most important evaluation question since the main objective of the interventions was to improve health and in particular the prevalence of diarrhoea among children under 5 years of age. The survey collected information on the prevalence of water related diseases for each of the household members in the sample. This is a recall question asking for the prevalence of water related diseases in the household during the six months preceding the interview. This question is an adapted MICS indicator[36] and has been asked in both survey rounds. Unfortunately, it is very imprecise; leaving the interpretation of what exactly is a water related disease to the respondent. For this reason the original MICS question was added to the 2010 survey round, asking for the prevalence of 'diarrhoea' among under five year old children in the household during the last two weeks.

The information on the first question (on water related diseases) is summarised in Table 43. To reduce recall error the MICS indicator has been further modified.[37] Household members were counted as 1 if they reported any member to have been affected by water related diseases during the last 6 months, and counted as 0 otherwise. The Table shows that there was a very large decrease in disease prevalence thus measured between the two survey years, from 30.5% to 14.2%. However, the decrease is smaller for locations where no interventions took place. In locations with a water or CATS intervention the decrease was much larger.

The numbers in the Table raise questions about what exactly is being measured by the MICS indicator. For instance, according to the final report on the 2003 DHS survey (GOM, 2005) prevalence of diarrhoea (2 week recall) among children under 6 years of age was 14%. As mentioned in footnote 37, estimating prevalence of water related diseases without modification on the basis of survey data leads to a much lower percentage, suggesting that

35 Disease burden is often measured in terms of 'DALYs', or Disability-Adjusted Life Years.

36 MICS stands for Multiple Indicator Cluster Surveys. These surveys have been developed by UNICEF to produce internationally comparable indicators on a range of indicators in the areas of education and health.

37 If prevalence is calculated using the original survey question, by dividing the total number of patient days reported over six months by the total number of person days the prevalence rate is 0.003 in 2008.

many (child) diarrhoea episodes may have been missed by the question. It is therefore important that this issue is addressed in the third round of the survey. The numbers in Table 43 are therefore only approximations of actual disease prevalence.

Unfortunately, responses to the second question (on two-week recall prevalence of diarrhoea among under-five year olds) are not informative either. They suggest a prevalence of 3.8% in the sample, which is again far below the 14% mentioned above for the year 2003. Moreover the numbers of diarrhoea cases reported for other household members are so low that they are not suitable for further statistical analysis. They will therefore be ignored in this report.

Table 43 Prevalence (6 months recall) of water related diseases (percentage of households with any case of illness in last six months)

Mean water related disease prevalence (%)		Interventions			
	Overall	No intervention	Water only	CATS only	Water and CATS
2008	30.5	28.8	27.1	44.6	31.1
2010	14.2	17.7	9.4	15.0	11.4
Change	-16.3	-11.1	-17.7	-29.6	-19.7

Source: Household survey and programme data on interventions

Whether the changes in Table 43 can be attributed to the interventions is investigated in the regression analysis reported in Table 44. The main result in the Table is a major impact of CATS sanitation training interventions on the prevalence of water related diseases: households living in locations where such training was given interventions took place are 8.1 percentage points less likely to report water related diseases, controlling for household size and time-invariant location effects.[38] This effect is sizeable: given that 36.5% of households live in locations that have received the CATS intervention, the effect can be estimated as 0.365 x 0.081, or about 3 percentage points. This amounts to 18% of the decline of prevalence in the sample. Note that this is a fairly robust result since the technique of double differencing neutralises the effects of all confounding variables that do not change (much) over time.[39] The regression in Table 44 also indicates that the water interventions have no significant effect on disease prevalence.[40] This is in line with the literature which stresses the importance of sanitation and point-of-use water treatment compared to

[38] The significance level of 0.053 is slightly above the level of 0.05 usual in impact studies.

[39] In fact, a 'level' regression relating disease prevalence in 2010 to the interventions would lead to the opposite result, namely that the water intervention is effective and sanitation training is not. This reflects the 'selective' placement of the sanitation training: these were targeted on relatively poor locations which had a relatively high water related disease prevalence in 2008.

[40] To corroborate the findings on the impact of CATS intervention and water interventions the data have been analysed in several other ways: conditional logit analysis, regression at the cluster rather than the household level, cluster fixed effects instead of household fixed effects. All methods give the CATS interventions have a favourable health impact matter and the water interventions do not. Also, the size of the effect changes very little between different methods.

ensuring that water quality is high at the source. See also the discussion on contamination of water between source and point of use on page 57 above.[41]

Note that the regression is a 'black box' regression in the sense that it establishes that there is an effect, but not through which channels. However, recall from the discussion of Table 33 and Table 34 that CATS intervention has a favourable impact on the ownership and use of latrines. Quite plausibly this is the channel linking the intervention to the health impact.

Table 44 Health effect of interventions

Dependent variable: change in prevalence of water related diseases (6 months). No disease 2008, disease 2010 = 1, disease 2008, no disease 2010 = -1, otherwise 0.				
Mean dependent variable:	-0.163			
	Estimate	**Clustered Standard Errors**	**t-value**	**Pr(>|t|)**
(Trend)	-0.116	0.029	-3.95	0.000
Household location had water intervention	-0.007	0.039	-0.19	0.853
Household location received CATS intervention	-0.081	0.042	-1.93	0.053
Change in household size	0.033	0.007	4.68	0.000

Source: Household survey and programme data on interventions. N = 1280 (households interviewed in both rounds). Adjusted R-squared: 0.023

The regression in Table 44 is at the household level, therefore it is not able to assess whether the interventions have a different impact on the young children and the rest of the family. Results of a regression using health information of all household members in both rounds[42] show that, indeed, the interventions have a different impact on the children under 5 years of age and the older household members: children under 5 are 5.9 percentage points less likely to have a water related disease in the communities with a water point intervention. For the older household members the water interventions do not show a significant impact. Regarding the CATS intervention, the impact is stronger for the older household members (4.2 vs. 2.9 percentage point reduction). The regression results also confirm that children under 5 are the most vulnerable to water related diseases, they are 6.5 percentage point more likely to contract a water related disease.

41 It may objected that the regression (regrettably) uses a transformation of an imprecise measure of disease prevalence. The imprecision does not lead to biased estimates, although it makes them less precise. Technically the reason is that it constitutes measurement error 'on the left hand side'. While there is no bias it should be noted that regression coefficients measure the change in the transformed prevalence. However, since this is systematically related to the measured prevalence, it is legitimate to draw conclusions on health impact.

42 The pooled regression controls for household, cluster and year fixed effects to circumvent selectivity bias. Additional regressors are age of the household member and household size and wealth.

The regression can be interpreted as a clear sign of programme impact on health. The question about the health impact in terms of what this implies for the disease burden (measured in DALYs cannot be answered) is impossible to say in view of the problems noted above with the indicator used.

4.6 The One Million Initiative and Education[43]

Evaluation Question 20. What has been the effect on the number and percentage of schools with a functioning improved water source in the school yard or within 200 meters from the school yard?

The survey found that 38 of the 80 schools (48%) had a functioning improved water source within 200 meters from the school yard. Most of the new water points were installed in 2008 prior to the baseline. This makes it difficult to assess the effect of the interventions.

Table 45 reports the number of improved water points at the surveyed schools. In 2010 59 out of 80 (74%) of the schools had an improved water point; in 38 schools these water points were functioning and within 200 meters from the school yard. The increase in improved water points at schools is almost exclusively attributable to the programme. It is more difficult to assess the effect of the interventions in 2008 because most of them were already completed before the baseline survey. From the 20 schools with water point intervention in 2008 15 schools have an improved water point within 200 meters.

Table 45 Water point interventions at schools

Drinking water source in 2008	Overall	No intervention	Water point intervention in 2008	Water point intervention in 2009
Improved	41	26	13	2
Improved & functioning	36	21	13	2
Improved & within 200 m	23	15	8	0
Improved, functioning & within 200 m	21	13	8	0
Drinking water source in 2010				
Improved	59	29	18	12
Improved & functioning	51	22	18	11
Improved & within 200 m	45	20	15	10
Improved, functioning & within 200 m	38	13	15	10
Change in drinking water source				
Improved	18	3	5	10

[43] Most of the analysis in this section uses data from the school survey and the water point and CATS interventions that were implemented in the framework of the CFS initiative (see Chapter 3, section 3.2). The results are therefore representative of the Child Friendly schools and no conclusions can be drawn for schools in general.

Change in drinking water source				
Improved & functioning	15	1	5	9
Improved & within 200 m	22	5	7	10
Improved, functioning & within 200 m	17	0	7	10
Total schools	**80**	**48**	**20**	**12**

Source: School survey and programme data on interventions

Evaluation Question 21. What has been the effect on the change in the number and percentage of schools with latrines (separated for girls, boys and school personnel)?

The number of schools with latrines increased from 65 to 74. In 2010 71 out of 80 schools had separate latrines for boys and girls. There are no longer any schools where latrines are used by everybody (staff and students) or used by both boy and girl students.

A well-known issue in Mozambique is the lack of sanitary facilities in schools. The school survey evidence documents this: in 2008 there were only 2.8 latrines per school serving an average of almost 500 children. This number increased to 3.6 by 2010. As Table 46 shows, both the total number of latrines and the number of gender specific latrines went up considerably between 2008 and 2010.

Table 46 Number of schools with latrines and use by specific groups

Number of schools where latrines are used by...	2008	2010
Everybody	10	0
Male teachers and students only	5	0
Female teachers and students only	2	0
Male and female students only	7	0
Boys only (students)	47	71
Girls only (students)	46	70
Male and female teachers only	16	51
Male teachers only	27	21
Female teachers only	14	11
Total number of latrines	**225**	**287**

Source: School survey

Evaluation Question 22. Do these schools have an operation and maintenance system in place?

The number of schools with an operation and maintenance system in place increased from 32 (40% of the sample schools) to 56 (70%).

Cleaning of the latrines is typically done by the schools' students.

Evaluation Question 23. What has been the effect on the use of latrines for girls, boys, school personnel?

Students increasingly use latrines, reflecting the improved availability of facilities.

At each of the survey schools ten students were randomly selected and asked about their use of latrines. The results are shown in Table 47. They clearly reflect the increased number of latrines available at the schools: in the vast majority of schools (66 out of 70) all boys and girls used latrines by 2010. No data are available on latrine usage by school personnel.

Table 47 Latrine use by students

	2008	2010
Number of schools		
Boys		
Nobody uses latrines	16	3
Everybody use latrines	51	66
Latrines are being used but not by everybody	3	1
Total responses	70	70
Girls		
Nobody uses latrines	16	3
Everybody uses latrines	48	66
Latrines are being used but not by everybody	6	1
Total responses	70	70

Source: School survey, only including schools with data for both survey rounds

Evaluation Question 24. What has been the effect on handwashing practices for girls, boys, school personnel (before meals and after going to the toilet)?

The practice of handwashing after defecation has become much more common: in 2010 there were only 12 schools (out of 68) in which none of the girls and boys wash their hands. In 2008 the number was much higher: 57 for boys and 58 for girls. No data are available on handwashing by school personnel. Also no information is available on handwashing before meals.

In the 2010 round of the school survey enumerators were asked to check the presence of handwashing facilities. Fifty out of 80 schools have such facilities. Students were asked about their handwashing practices after defecation. Table 48 shows that handwashing was remarkably more common in 2010 than in 2008, presumably reflecting increased hygiene awareness promoted in the Child Friendly School programme, although this cannot be verified from the school survey data. As with latrine usage, no data are available on handwashing practice by school personnel.

Table 48 Handwashing practice of students		
	2008	2010
Number of schools		
Boys		
Nobody washes hands	57	12
Everybody washes their hands	6	42
Most boys wash their hands	3	12
Almost nobody washes hands	2	2
Total responses	68	68
Girls		
Nobody washes hands	58	12
Everybody washes their hands	8	44
Most girls was their hands	1	11
Almost nobody washes hands	1	1
Total responses	68	68

Source: School survey, only including schools with data for both survey rounds

Evaluation Question 25. What has been the effect of programme interventions on school enrolment and outcomes (for girls and boys)?

> *Enrolment in the sample schools hardly changed between 2008 and 2010 and is not related to interventions at the school. Also, there is no notable effect on passing rates. At the household level there is a modest increase in enrolment, which also is not related to the interventions.*

The One Million Initiative can affect school enrolment and educational outcomes both through its school component interventions at the CFS districts (new water points, latrines and CATS intervention) and through the community interventions (new or rehabilitated water points and CATS intervention). Using data from the school survey, we first analyse the impact of the school level interventions. Unfortunately, there is no information in the surveys on the community level interventions around the schools. In the analysis it is therefore assumed that the school and community level interventions are independent. Data from the household survey were used to analyse the impact of the community interventions on school enrolment.

The enrolment data for the 80 survey schools are summarised in Table 49. These schools showed a slight decline of 10.3 pupils per school in enrolment between the two years. Girls' enrolment seems to catch up with that of boys. There does not seem to be a relationship with water or latrine interventions. Regression of the school enrolment on interventions (not reported) confirms this conclusion.

Table 49 Enrolment and interventions in survey schools (average number of pupils per school)					
Enrolment at school		**Interventions**			
2008	**Overall**	**None**	**Water only**	**Latrine only**	**Both**
Boys	281.6	341.3	216.9	253.6	244.5
Girls	226.3	269.0	153.1	228.7	199.6
Total	508.0	610.3	370.0	482.4	444.1
2010					
Boys	269.8	318.8	216.6	231.9	247.3
Girls	227.8	259.0	175.8	206.0	220.0
Total	497.7	577.8	392.3	437.9	467.3
Change					
Boys	-11.8	-22.5	-0.3	-21.7	2.8
Girls	1.5	-10.0	22.7	-22.7	20.4
Total	-10.3	-32.5	22.3	-44.5	23.2
Total number of schools	**69**	**28**	**9**	**11**	**21**

Source: School survey and programme data on interventions, omitting 5 schools without enrolment information in 2010

Apart from enrolment one might expect a positive effect of water interventions on attendance, and hence on passing rates. However, a notable effect is not present in the data. This does not come as a surprise, given the complexity of the educational process.

The previous discussion has looked at enrolment and other schooling outcomes from the perspective of the 80 survey schools. These schools are located in different districts than the households in the household survey. The household survey also includes enrolment information on children in the household. According to the household survey enrolment increased between 2008 and 2010, especially for girls (Table 50): a total increase of 9.1% against 4.5% for boys. In 2010 enrolment of girls has almost caught up with enrolment of boys. However, this increase does not appear to be systematically related to water and sanitation interventions.

Table 50 Percentage of school age children enrolled in school				
	Age	2008	2010	Change
Girls	6	72.5	50.3	-22.3
	7	77.1	72.5	-4.6
	8	45.8	84.4	38.6
	9	62.8	71.9	9.0
	10	54.5	85.1	30.5
	11	88.5	89.0	0.5
	12	59.0	86.8	27.8
	13	61.6	73.4	11.8
	14	57.2	77.0	19.7
	15	53.1	68.6	15.5
	16	57.0	52.8	-4.2
	Total	65.0	74.0	9.1
Boys	6	92.3	50.6	-41.7
	7	65.1	69.3	4.2
	8	71.1	75.4	4.3
	9	74.4	77.3	2.9
	10	62.0	88.6	26.6
	11	60.2	86.6	26.4
	12	64.8	89.0	24.2
	13	54.0	82.9	28.9
	14	59.3	80.5	21.2
	15	76.8	73.9	-2.9
	16	62.6	68.9	6.3
	Total	72.1	76.6	4.5

Source: Household survey

The regression in Table 51 confirms that for girls the changes in enrolment are mostly driven by other factors. The regression relates the change in the percentage of school age girls in each location to water and CATS interventions, controlling for changes in age. None of the interventions are significant in the regression. The same regression for boys gives similar results and is not reported here.

Table 51 Girls' enrolment and programme interventions				
Dependent variable: change in the share of school age girls enrolled in school: location average				
Mean dependent variable	0.071			
	Estimate	**Standard Error**	**t-value**	**Pr(>|t|)**
trend	0.069	0.036	1.903	0.061
Water intervention	-0.016	0.057	-0.284	0.777
CATS intervention	-0.014	0.059	-0.236	0.814
Change in average age	-0.086	0.036	-2.381	0.020

Source: Household survey and programme data on interventions. Number of observations (locations) = 80. Adjusted R-squared 0.035

This suggests that the water interventions at the community level do not increase enrolment. This is somewhat surprising since the interventions reduce the burden of fetching water – typically a task for women and girls. Recall however, that there is a strong effect of water facilities at the schools.

4.7 Summary

Between 2008 and 2010 the number of households using improved water points increased massively, but the number of points is still far below the target of 1 per 500 people. This improved access is visible in official statistics, programme documentation and survey outcomes. Rough estimates of the water user population indicate that the average number of persons per water point has fallen, especially in the targeted poorer section of the population, where it declined from around 3,750 in 2008 to 1,250 in 2010.

The water and sanitation interventions (notably the CATS intervention) have induced a large number of households to switch to improved water sources. This has led to a substantial increase in water quality at the source and also at the point of use. Unfortunately, 18% of the improved water sources are contaminated. Moreover, water that was uncontaminated at the source is often contaminated at the point of use.

About one third of households in communities with a water point intervention did not switch to an improved source. Use of improved water sources is mainly determined by distance to the improved source. There is a strong case for disseminating reliable information on water quality at the source: households base their decision to switch to an improved source on their assessment of its quality and that judgment is quite inaccurate. Where households perceive water quality to have improved they have also started using more water. In general, however, the quantity of water used has fallen in the 2008-2010 period, a worrying finding.

The vast majority of households use the same water source for all domestic purposes. The quantity of water consumed from improved water sources is low and even fell between 2008 and 2010.

The CATS intervention is very effective in reducing the practice of open defecation and in inducing people to build and use latrines. This is remarkable in view of the disappointing results of other hygiene awareness interventions, in Mozambique and elsewhere. However most of the latrines do not satisfy the criteria for adequate and safe sanitation.

Cleanliness of latrines has improved and handwashing with soap or ash has increased. Also the practice of water treatment has become more common. These changes are most prominent in locations with CATS interventions. No evidence of impact on other hygiene practices was found and only very few households satisfy all conditions for reducing water borne diseases.

To assess the health impact of the One Million Initiative this chapter has used an indicator based on an established MICS indicator for water related diseases. There can be some severe doubts about the relevance of this indicator since it appears to miss most of diarrhoea cases.

While there are problems in the way health outcomes have been recorded, there is strong evidence of a substantial reduction in the prevalence of water related diseases as a result of the CATS interventions. This is the most important finding of the evaluation. It is also clear through what channel this result was achieved: the CATS intervention has induced people to build and use latrines; this explains the observed health impact. The intervention explains about one sixth of the observed decline in prevalence.

Enrolment in schools increased modestly, particularly for girls, but this is not related to the interventions under the One Million Initiative, neither at the schools or at the community level. The number and use of latrines in schools increased, in particular of single sex latrines. The practice of handwashing after defecation has become much more common in schools.

5

Sustainability assessment

5.1 Introduction

The value of any development intervention must ultimately be assessed in terms of the sustainability of its impact. The overarching question for this evaluation is therefore whether the benefits being achieved by the One Million Initiative are sustainable. Definitive conclusions about sustainability can only be reached in the long term, on the basis of empirical observations about whether the intended beneficial impacts continue to be enjoyed. The One Million Initiative is only a little over half way through its implementation period. It may therefore seem premature to be assessing its sustainability. But experience suggests that a number of factors commonly influence the sustainability of rural water and sanitation interventions, and that it is useful to start identifying their presence or absence at an early stage, when the programme itself can sometimes still influence them. This chapter of the mid-term study therefore offers preliminary observations on trends towards sustainability, with particular reference to the evaluation questions 26 – 30 that were posed by the terms of reference (Annex 1). These observations are directed towards the study's broad purpose of learning and sharing lessons with regard to the impact and sustainability of interventions like the One Million Initiative – and not as part of a performance evaluation of the project, for which the Netherlands and Mozambique governments have other arrangements. As is usually the case, the project has clearly defined goals with regard to physical outputs, but sustainability targets are less thoroughly specified and will be a matter for on-going consultation between the two governments and UNICEF. This study hopes to contribute to the evolving discussion about what sustainability means and how it can be promoted in the rural water and sanitation sector.

The TOR summarise the types of factors that affect sustainability.

> *First, environmental factors play various fundamental roles in determining sustainability (for example influencing availability of groundwater). Secondly, a set of technical factors affect sustainability, such as durability of water supply infrastructure. The third set of factors are behavioural factors explaining uptake of water, sanitation and hygiene messages, such as the degree to which people perceive the messages to be true, observe benefits and perceive higher costs or labour to be a good trade-off for the benefits. The fourth set of factors are economic: what resources is society able and willing to invest in the installation, operation and maintenance of water supply, sanitation and hygiene promotion arrangements and how are costs and benefits of these investments distributed across society and over time? Finally and linked in various ways to the other sets of factors, the structure, quality and performance of institutions are major determinants of the sustainability of rural water supply, sanitation and hygiene promotion programmes. These institutional factors, linked as they are to the fundamental quality of society's governance and politics, are often the most influential and complex determinants of water, sanitation and hygiene standards. The assessment therefore gives them special attention.*

The next two sections of this chapter pay special attention to the **institutional** factors just mentioned. Section 5.2 answers Evaluation Question 26 about whether an appropriate national policy framework and institutions are in place. Section 5.3 addresses Evaluation Questions 27 and 28: whether government, NGOs and the private sector have the capacity to sustain the required services (27); and whether sustainable management by beneficiary communities and schools is assured (28). These issues are linked in Section 5.4 to the key

economic question of affordability. Section 5.4 answers Evaluation Question 29, as to what other issues affect the sustainability of the benefits. It reviews some of the **environmental**, **technical** and **behavioural** factors that affect sustainability and are mentioned in the TOR. Institutional issues are also prominent in the quality of the monitoring that must underpin the operation of rural water and sanitation. These issues are addressed in Section 5.5, which answers Evaluation Question 30: whether the government **monitoring** system for community-based safe water and sanitation results and sustainability is focused and whether information is used to keep track of community-based services and address bottlenecks in a structural way.

5.2 Policy and institutional arrangements

Evaluation question 26. Are an appropriate national policy framework and institutions in place?

> *The answer is largely positive. Two decades of wide-ranging reform have established a broadly appropriate national policy framework and institutions for rural water and sanitation in Mozambique. This framework has been conducive to good progress by the One Million Initiative, although programme experience also reveals weaknesses and ambiguities in current policy and institutional arrangements. Some of the detailed approaches and institutional experience of this programme are expected to feed back into national practice through PRONASAR.*

The One Million Initiative has worked within the national Mozambican policy framework, without attempting major changes to it. Key strengths of the approach in Mozambique and the One Million Initiative include the emphasis on user responsibility for the management of rural water supplies, and the decentralised arrangements for a strong local government role in the implementation of water and sanitation services and their longer-term support. However, a number of weaknesses and ambiguities qualify the contribution that policy and institutions can currently make to sustainability. These are questions of national policy as it is applied at local level.

One obvious issue is that so much of the institutional framework is still so new. Arrangements to give a stronger role to district administrations, with provincial Departments of Public Works and Housing in a technical support and oversight role, are new. Many of the procedures are still being developed; there is little experience with the new dispensation. Many of the district planning and infrastructure offices (SDPIs) are still at an early stage of their development and potential contribution to the sub sector. The One Million Initiative has been making major contributions in this regard, funding many of the district technicians posted to SDPIs in the three programme provinces. Government is responding by gradually taking programme-funded personnel onto its own establishment and payroll, as administrative procedures and budgets permit.

The principal ambiguity in current arrangements concerns the economics of user responsibility. Experience under the One Million Initiative, elsewhere in Mozambique and beyond confirms that the operation and sustainability of rural water supply are enhanced if the

infrastructure is treated as a community asset, with users required to contribute to its installation and meet the costs of its upkeep. But there is also widespread consensus – confirmed by observations and discussions in the programme area – that rural communities will not be able to meet the full maintenance and depreciation costs of this infrastructure in the short to medium term. With appropriate institutional arrangements – successfully promoted by the One Million programme – they should be able to meet minor routine maintenance costs (although with mostly new infrastructure there has been relatively little need for this so far). Major repairs and the ultimate replacement of worn out pumps are not affordable at current or foreseeable levels of community contribution and user fees. The 2010 survey shows that a majority of users interviewed consider the water charges that they pay to be reasonable or cheap. Nevertheless, raising these charges to cover the full long-term costs of the service would certainly exceed users' ability to pay – and elicit a very different response.

This problem is widely recognised at central and local government levels in Mozambique. Many in SDPIs in the three programme provinces, for example, assert that local government will do all its resources permit to assist communities with the cost of major repairs or pump replacement. But full clarity, and a guarantee to users of government support for sustainability with regard to this basic human need, are lacking in current policy. An element of subsidy will be required for the foreseeable future.

A second major ambiguity concerns institutional maintenance and the role of NGOs. The sustainability of rural water and sanitation depends at least as much on institutional maintenance as it does on technical maintenance. Community-level institutions require long-term advisory support and facilitation if they are to remain effective in their essential roles – or survive at all. Under the One Million Initiative, the PEC Zonal approach to community social mobilisation and local institutional support is proving effective. But this approach is delivered by NGOs that are paid by the programme. There is no clarity about how such support will be provided after 2013. What is clear is that the support will be needed for many years longer. Again, SDPIs aim to give all the help they can, possibly in collaboration with the health and education units of district governments. This is unlikely to be adequate. Another option is that long-term institutional maintenance services are established as a standard function to be funded through PRONASAR in the One Million Initiative provinces after 2013, and everywhere else in Mozambique where the appropriate user institutions have been established. This would imply clear and effective arrangements to ensure that PRONASAR funds reach district level, and that PRONASAR operates as a programme for recurrent support as well as capital development.

The private sector plays a much less prominent role in Mozambique's rural water supply and sanitation sub sector than it does in the country's urban services. Nevertheless, that role is vital. Policy assumes that the private sector will respond to demand for its technical services as programmes like the One Million Initiative stimulate that demand – most specifically through borehole drilling contracts, the manufacture and sale of latrine slabs, the sale of spare parts and on-going maintenance of hand pumps and boreholes. However, much of the demand is scattered and intermittent. Drilling companies have responded to the

demand for new wells, with mostly (but not wholly) satisfactory results in the case of the One Million Initiative. Demand for latrine slabs has so far proved too weak to be attractive to entrepreneurs on a more than occasional basis. Similarly, parts sales and borehole and pump repair services are only a viable business proposition in areas where substantial amounts of such infrastructure are installed; where the infrastructure is no longer new and more frequently needs repair; and where user groups and/or local government have the funds and institutional ability to employ technical service providers. In the One Million Initiative districts, most of the infrastructure does not yet need much repair; demand is low; and there is little private sector development. In the longer term, and in areas where there is currently a stronger need for repair services, market forces are unlikely to be sufficient to ensure that technical supply meets maintenance demand. A facilitation input will be needed to ensure that community clients know where technical services can be sourced, and maintenance entrepreneurs know how to link to their scattered and sometimes poorly organised market. Again, current policy and institutional arrangements are insufficiently clear on these points. One option would be to clarify technical and institutional maintenance policy and procedures in an integrated manner, specifying the roles of user groups, local government and non-governmental service providers (i.e. NGOs and entrepreneurs).

5.3 Institutional capacity

Evaluation question 27. Does the government at provincial and district level, NGOs and private sector involved have the capacity to provide the required services and for sustaining services in the long term?

> *The answer is broadly positive. Good progress has been made with building capacity in all three sectors. Government commitment and action with regard to absorption of programme-funded posts into its establishment are encouraging. NGO capacity is never likely to be stable; future provision for using it is uncertain. Private sector capacity will respond to market conditions, which are not wholly favourable.*

Evaluation question 28. Is sustainable management of the facilities by beneficiary communities and schools ensured?

> *Sustainable management by beneficiary communities is not yet assured, despite promising progress to date. While it is relatively easy to be confident about sustainable management of water and sanitation infrastructure at schools, the required management capacity in communities will take years of committed effort to consolidate.*

State institutions

The institutional model adopted by the Government of Mozambique and the One Million Initiative places much of the responsibility for sustaining rural water and sanitation on users and their community institutions. Numerically and fiscally speaking, the capacity that state institutions need to maintain in order to fulfil their roles in the sub sector is relatively modest. As noted in section 3.3, the programme has recruited 12 staff to join the provincial Departments of Public Works and Housing, and a further 18 technicians to work within

SDPIs at district level. It has provided a series of training inputs that have significantly strengthened the capacity of programme staff and their existing government colleagues. A growing proportion of the 30 individuals recruited by the programme have been transferred to the GOM establishment and payroll, and – unless unforeseen fiscal constraints intervene – it is likely that all these posts will be transferred by the end of the programme in 2013. This significantly increases the prospects for sustainable institutional capacity within provincial and district governments. However, that sustainability is of course not assured: it will always depend on the adequacy and allocation of government's budgetary resources, and on the knowledge, skills and experience of the staff in post (which may be jeopardised by frequent staff rotation). Furthermore, as emphasised above, this is capacity for the model that Mozambique has adopted, which relies also on appropriate capacity being in place in the non-governmental and private sectors as well as in user communities themselves.
The One Million Initiative and its government colleagues view transport and office infrastructure as an important part of institutional capacity. Vehicles, computers etc. are certainly vital for the effective performance of government's roles in the sub sector, and their on-going availability is an important part of the sustainability challenge. Programme reports often refer to the provision of such infrastructure as a contribution to institutional sustainability. It is not. Only government (with possible further donor support through PRONASAR) can assure that this dimension of sustainable capacity is achieved through future recurrent budgetary provision. Whether it will be able to do this cannot be guaranteed.

The government and programme staff working on rural water and sanitation in the One Million Initiative provincial and district teams appear competent and committed. With guidance from DNA and UNICEF, they are making an increasingly effective contribution in often difficult circumstances. One reason why government and UNICEF have been able to develop this capacity is that there are relatively few other opportunities for qualified personnel in these provinces and districts. Properly managed, the civil service in poor areas with low levels of economic activity can 'benefit' from the fact that there are few competing opportunities to tempt its personnel. This is starting to change, notably because of the expansion of mining activity in Tete province. As the economy develops, government is starting to lose skilled people. It is obviously to be hoped that the economy will become stronger and that employment opportunities for Mozambicans will expand. But this may threaten the government staff capacity that the One Million Initiative has helped to build, and create a longer-term capacity building challenge. Mozambique will increasingly have to deal with a common problem in expanding low- to middle-income economies: maintaining the quality of the civil service in the face of budgetary constraints and booming demand for skilled people in the private sector.

Non-governmental organisations

NGOs are a more essential part of the institutional model for rural water and sanitation in the One Million Initiative (and, by implication, PRONASAR) than is commonly recognised. As was noted in section 2.5, it is not always useful to distinguish them from the rest of the private, or non-governmental sector. Both NGOs and private companies are engaged in PEC

contracts for the One Million programme. The key question is whether there is long-term capacity for the animation, facilitation and institutional maintenance services that NGOs have been providing through the One Million Initiative. The current level of capacity, and quality of service, is uneven, as is the character of the providers: some international NGOs and some local ones. Like any client, government will in future have to impose quality controls to ensure appropriate levels of performance, just as the One Million programme is doing now. Fundamentally, however, the longer-term assurance of this kind of capacity depends on whether the strategy of using non-governmental service providers is institutionalised in and funded by PRONASAR. This depends, in turn, on whether government and PRONASAR recognise and resource the levels of on-going institutional maintenance that rural water and sanitation services will require, as argued above. Although inadequate, there is an established level of NGO capacity for this kind of work. If the demand is institutionalised, the capacity is likely to grow to meet it.

The private sector

The same argument applies to what is more usually called the private sector. For the reasons outlined in section 5.2 above, the private sector does not currently offer the kind of capacity that sustainability of rural water and sanitation services in the One Million initiative districts will require. In other market conditions, entrepreneurs would develop it. Those conditions do not currently prevail. The One Million Initiative has attempted to nurture private sector capacity through the formation of artisans' associations, facilitating the signature of agreements between community water committees and artisans or associations that would provide maintenance services, and encouraging traders and other entrepreneurs to keep stocks of spare parts for water supply infrastructure. Like many attempts to influence market behaviour in developing economies, these efforts have had indifferent results. There is consensus that the artisans' association model does not work. Most of the associations that were established have effectively disbanded. Individual traders and mechanics are only weakly networked with what is typically a weak market in the One Million Initiative districts, although water committees usually are aware of who their local service providers are. Understandably, these entrepreneurs so far show only limited interest in building and maintaining the sort of technical capacity that the sector will need in the longer term. Facilitating the emergence of this interest will be one dimension of the institutional facilitation and maintenance services that will continue to be needed long after the One Million programme ends.

Users and community institutions

As was noted at the start of this section, sustainable management of the water and sanitation facilities introduced by the One Million Initiative depends heavily on users and their community institutions. Especially in the context of sustaining appropriate sanitation practices – rebuilding latrines, for example, or maintaining ODF status – the question of capacity blends into that of motivation at this local level. Rural people and their institutions must have the technical capacity to operate and maintain their local utilities and practices. They must also be motivated to find this worth the significant effort and opportunity cost.

The One Million Programme has instituted a hierarchy of training processes and events aimed at building community capacity. This largely appropriate approach is likely to be replicated across increasing areas of the country as procedures are enhanced and harmonised through PRONASAR. It starts with training of trainers, who go on to train the staff of the NGOs contracted to undertake PEC activities. These staff, and especially their local-level animators, are then responsible for the PEC Zonal campaigns and more intensive work in target communities that raise individuals' awareness and commitment with regard to water, hygiene and sanitation, as well as the series of training events delivered to community activists, community leaders and water committees.

The rising number of ODF communities, of latrines and other household hygiene and sanitation initiatives and of functioning water committees are all testimony to the effectiveness of these community capacity building efforts. The strongest achievement is the ownership that communities now feel and express with regard to local water infrastructure that they previously considered to be the property and the responsibility of government. However, the 2010 survey still found that less than a third of the water points visited reported having a committee (section 3.3). So community institution-building has a long way to go; and the youth and inexperience of most committees that do exist (two thirds established in 2008 or later) are one reason why the sustainability of this capacity is still far from assured. There are two key issues.

First, meetings with community structures, such as those undertaken for this review, quickly reveal that understanding, skills and procedures are not yet deeply rooted. Commitment and enthusiasm often appear high. But the approaches and especially the administrative procedures introduced by the programme are often inconsistently or incompletely implemented. Institutional accountability mechanisms are not yet strong. There is no direct reason to suspect corrupt practice, but committees' financial record keeping is often incomplete or internally contradictory. Easier access to banking services would help build user trust in the custody of public funds, promote transparency and enhance record keeping – although it would not be a complete solution to any of these problems. For the time being, much of the financial detail still has to be taken on trust. External audit procedures exist, but are not comprehensively applied. None of this is surprising. The introduction of the new structures and procedures is still very recent and is a significant innovation for communities with limited literacy and little experience of formal, paper-based administration. More fundamentally, it must be recognised that institutional maintenance and support are a permanent requirement. The One Million Initiative cannot 'build capacity' over a couple of years and consider the job done. Refresher training (partly, but not only for newly elected officials) and advisory support will be needed into the indefinite future. Only after a decade of such support can there be more confidence that community capacity will be sustained.

The second issue links to the first. Activists are key to building capacity at this level. Drawn from within the community and currently provided with a bicycle and paid MT 600 – 745 per month by the One Million Initiative through the PEC NGOs, they play a vital role in building and maintaining people's commitment to hygiene and sanitation and in daily support to

water and sanitation committees. Very few would be likely to continue this active role if they are no longer paid after the end of the programme. This would significantly jeopardise the sustainability of the capacity that they have helped to build. But longer-term arrangements to pay them, for example with PRONASAR funds through PEC NGOs that are maintained in some support role in association with district SDPIs, would have to be reconciled with current government pay scales for community leaders. Despite their status and responsibilities, these leaders only receive MT 500 per month at the highest grade, with the second grade receiving MT 300 per month. Whatever solution is adopted, it is unlikely that community capacity can be assured without effective measures to keep activists active.

Schools

Sustainable management of water and sanitation infrastructure at schools is easier to assure. School management structures are already in place and, with a modicum of training and support, should be able to extend their management functions to the effective maintenance of the new facilities. As noted in section 4.7, the proportion of survey sample schools with an operation and maintenance system in place increased from 40% to 70% between 2008 and 2010. Contributions by school children to the cleaning and minor maintenance of water points and latrines can logically be linked to their education on hygiene and sanitation. Most schools have existing links with parents and communities that can also mobilise support for maintenance work. Needless to say, the introduction of a safe water supply to a community which has a school but previously had no such facility can have multiple, mutually reinforcing benefits whose beneficial impact on sustainability is greater than the sum of their parts. Not only are pupils' hygiene and health likely to improve, but water supplies make it possible to launch school feeding programmes that could not previously be attempted – enhancing enrolment and educational performance. Taken together, these factors are likely to reinforce community commitment to maintenance of public and school facilities.

The focus of institutional capacity

Overall, the development of institutional capacity for rural water and sanitation through the One Million Initiative mirrors experience in many other countries. The strongest capacity so far is focused on the technical aspects of rural water supply. Although much remains to be learned and improved, skills and procedures for groundwater extraction, water point development and related contract management have been well developed. Understandably, there is less assured capacity for institutional maintenance and for the social and behavioural skills and systems needed in promoting and maintaining appropriate sanitation and hygiene. National policy and the emerging PRONASAR give strong emphasis to user interests, attitudes and roles and to the importance of liaison between community leadership and local government structures in this sector. But it is too soon to be confident of sustained institutional capacity for these purposes among state, NGO and private service providers.

5.4 Other factors affecting sustainability

Evaluation question 29. Are there issues that affect sustainability of benefits, not captured under question 27 and 28? Have these been addressed and with what result?

***Environmental factors** are poorly understood, especially the potential impact of climate change. Although the geohydrology is broadly favourable, there are areas where groundwater extraction is expensive, difficult or so far unsuccessful. Increased attention to alternative technologies is planned, with some studies already under way.*

***Technical factors:** the technical quality of the infrastructure installed is one key determinant of the sustainability of benefits from improved water supply. Another important technical factor affecting sustainability is the number of users per water point. The sustainability of services and the impact of benefits will be enhanced when the average number of users per water point is reduced. There has been a lack of clarity about how Mozambique defines sustainable benefits with regard to sanitation. In any event, the sustainability of the initial strategy for promoting latrines with concrete slabs through demonstration centres and artisans' associations has lost momentum.*

***Behavioural factors:** understandably, communities where the One Million Initiative has recently delivered improved water supplies and enhanced sanitation arrangements are currently enthusiastic about the new infrastructure and express strong commitment to sustaining it. At this early stage, there can be no guarantee that they will. Internationally, there is little conclusive evidence about the sustainability of practices introduced through community-led total sanitation.*

Environmental factors

The programme's technical strategy, as in most of rural Mozambique, is to draw water from underground aquifers. Geohydrological conditions vary across the programme area, but are broadly favourable, with average extraction levels of 40-60 meters. Groundwater levels may rise and fall with the seasons. Wells and boreholes sometimes go dry during or after periods of low rainfall. At present, there is little prospect of groundwater extraction rates becoming unsustainable. With hand pump technology, the amounts of water used are comparatively small. However, the rates of and spatial variation in aquifer recharge are poorly understood in most areas. The climate change scenario for central Mozambique is not promising. More intense cyclones, floods and droughts are anticipated, along with a steady rise in temperature. What this means for the region's geohydrology is unknown. Predictions of future total rainfall are uncertain (McSweeney *et al.*, nd: 3-4). Climate change is a potential long-term influence on the sustainability of rural water supplies that depend on groundwater. More research in the short to medium term on its significance would be prudent.

Despite the extensive distribution of suitable groundwater, there are locations and areas where it cannot be found at suitable depths, or at all. One of the One Million programme's responses (in Machaze district) has been to vary the standard Afridev pump technology with an alternative, more expensive Afripump that can extract water from greater depths. This has inevitable consequences in terms of different training routines, spare part supply chains

etc. Other alternatives, notably spring protection, mini piped systems centred on one deep borehole and diesel pump, shallow wells and rainwater harvesting, are already in use and will be investigated for suitability in such areas in more detail with DNA over the remainder of the programme. Meanwhile, contractors drilling for the programme must now accept responsibility for blank boreholes. Despite this incentive to make more careful geohydrological investigations beforehand, negative borehole rates remain high in some areas – probably reflecting the lack of reliable information in many parts of Mozambique. Overall, 30% of boreholes drilled for the programme in 2009 were blank or saline. This means that the programme, and its clients, must confront the apparent impossibility of achieving a safe water supply for some communities with that technology. This is not a matter of sustainable impact; it is a matter of achieving no impact at all. Alternative approaches must therefore be developed – a challenge that the programme is currently tackling (section 3.4).

Technical factors

The technical quality of the infrastructure installed is one key determinant of the sustainability of benefits from improved water supply. In a few cases, apparently viable boreholes are put into service with the support of the programme, but their yields prove to be low (or sometimes fail completely) and the benefits correspondingly limited. Resolution of this kind of problem does seem feasible, provided that drilling contracts are adequately supervised, retention clauses enforced, and, if all else fails, the programme returns to make alternative arrangements that do achieve the intended sustainable benefits.

Especially in 2008, the One Million Initiative had significant problems with contractors using sub-standard materials for boreholes and pumps. With the use of stricter quality control and contracting procedures, it has largely (but not entirely) overcome these challenges. A recent Netherlands supervision mission criticised the quality of rehabilitation and construction work on some of the mini piped systems (GON, 2010: 13). Continuing vigilance will be necessary, and the tighter procurement and contracting systems will need to be standardised nationally through PRONASAR.

Overall, as shown in section 4.3, the proportion of improved water points that are functioning in the target areas that the programme expected to cover has increased substantially, from 54% in 2008 to 82% in 2010. However as will be shown below, the number of people using each water point is still so high as to jeopardise the sustainability of the new infrastructure.

Water points and piped systems pose differing maintenance challenges. The technical sustainability of pumps and boreholes depends on one array of capacity factors and a relatively large number of people – village operators, local mechanics, and effective local management structures. The technical sustainability of piped systems in larger settlements depends on different capacity factors, involving a smaller number of more highly trained individuals - and may be easier to assure if the utilities employing those staff themselves operate sustainably. Careful criteria and systematic decision making are clearly needed to guide the choice between separate water points and a reticulated system, based not only on current user distribution and installation cost but also on long-term maintenance considerations.

Another important technical factor affecting sustainability is the number of users per water point. Quite apart from the debates about whether coverage statistics are based on the standard 500 (or 300) people or the actual enumerated number of users per water point, there is a significant issue at this mid-term stage of the One Million Initiative with water points that are serving much larger numbers of people than either of these benchmarks. Data on positive boreholes drilled and equipped and actual numbers of users in the programme's progress report for 2009 indicate an average 913 users per water point. Figures for 2008 - 2010 (to 30 November) show an average of 989 (Section 3.4). There are two consequences. First, many users are not able to get the recommended 20 litres each per day from the water point, diminishing the beneficial impact achieved. A 'user' reported by the programme is not necessarily using the recommended daily amount of safe water. Indeed, the 2010 impact survey data show drinking water use of only 11.7 l/day from improved sources in communities where the One Million Initiative has only worked on the water supply, and less in communities where it has worked on only sanitation or on both water and sanitation. Secondly, more intensive use of hand pumps is likely to reduce their service life and exacerbate maintenance problems, potentially threatening the sustainability of the benefits. The programme is aware of this challenge and aims to address it. It certainly has been under pressure to extend coverage to as many places as possible, even if only with one borehole and pump where the population warrants more. There are plans now to infill extra facilities in areas where the project has already installed a first water point. In 2011, one criterion in selecting communities for the drilling programme will be population over 1,000 even where one water point has already been installed.

There has been a lack of clarity about how Mozambique defines sustainable benefits with regard to sanitation. The rapid expansion in the number of households using traditional latrines is undoubtedly beneficial, although such latrines may not be counted in formal enumeration of coverage for the purposes of MDG targets. The quality of traditional latrines varies, with some probably achieving similar sanitary performance to 'improved' ones. Should sustainable benefits with regard to latrine use be defined in terms of use of improved latrines with concrete slabs, or is this unrealistic or unnecessary? The incremental health benefits of such improved latrines are arguably marginal. Furthermore, sustainability is easier to achieve with traditional latrines that are more easily repaired or replaced, for example if they suffer structural damage or the pit becomes full. There is increasing policy attention in Mozambique to these questions. The PRONASAR meeting of November 2010 referred to in section 2.5 recommended "to adopt the safe sanitation concept [i.e. hygienic separation of faeces from human contact] for the definition of both rural and urban/peri-urban sanitation coverage", arguing that "it is probable that most of the traditional household latrines in the country (promoted through CLTS or other sanitation approaches) can be classified into the safe sanitation category" (PRONASAR, 2010: 2). Mozambique is presumably therefore ready to diverge from MDG definitions in this regard. The international debate on these issues is likely to continue. Some observers would support the PRONASAR decision, others might question it. However, whatever the latrine and floor/slab construction material, the provision of an effective lid remains essential for a latrine to achieve 'safe sanitation'. The November 2010 PRONASAR meeting agreed that DNA, with support from sector partners, should "develop a sanitation catalogue to define safe

sanitation and to be used in collecting data for the PRONASAR baseline in 2011" (PRONASAR, 2010: 2).

The outcome may make a significant difference to sanitation reporting on the country. In any event, the sustainability of the initial strategy for promoting latrines with concrete slabs through demonstration centres and artisans' associations has lost momentum. The public show limited interest, and artisans have lost motivation for this activity. No clear strategy has been put in place for the long-term management of the centres.

Behavioural factors

Understandably, communities where the One Million Initiative has recently delivered improved water supplies and enhanced sanitation arrangements are currently enthusiastic about the new infrastructure and express strong commitment to sustaining it. At this early stage, there can be no guarantee that they will. It was emphasised above that long-term institutional maintenance is a precondition for such sustainability. ODF communities are particularly enthusiastic about what they have achieved and vow never to slip back to old ways. A preliminary check in 2009 found that 12 of 13 sampled communities that were declared ODF in 2008 were still ODF a year later.

There is little conclusive evidence about the sustainability of practices introduced through CLTS, although reversion to previous practices has certainly been observed in Bangladesh: "...even though there is a shift in attitudes and a drive to change habits initially, the enthusiasm may eventually peter out once the facilitators have withdrawn, and the community's members over time fall back into their old routines." Overall, however, "monitoring and evaluation of ODF status is very weak in CLTS" (Movik and Mehta, 2010: 14). The 2010 Netherlands government supervision mission to the One Million programme stated that "the major challenge is the upgrading and consolidation of the community sanitation level. No proven approach is available yet". Current observation of ODF communities supported by the One Million Initiative suggests that pride in their status and peer pressure among individuals and households will help to make the enhanced sanitation practices sustainable. One of the tasks for long-term institutional maintenance in such communities will be to maintain current levels of awareness and commitment. In particular, as noted in Chapter 3, it is important to discourage the notion that achievement of ODF status is the end of a community's sanitation effort. Use of latrines is not enough to contain the risk of faecal contamination; they must be kept clean and closed by appropriate lids. Monitoring and support must be maintained at household level for the long term if sustainable sanitation benefits are to be achieved.

Impact at scale requires a clear, effective, simple, standardised approach that thousands of field staff and community leaders can all understand in the same way. In any large-scale endeavour, only a very small minority of those involved will spontaneously take the initiative to deviate from the guidelines and adapt implementation to specific circumstances. Most will simply do what the guidelines say, even if that is not entirely appropriate in local conditions. The One Million Initiative has achieved this strong, standardised approach

and is therefore able to deliver at scale, in ways that PRONASAR is likely to adopt for broader and longer-term implementation across the country. Inevitably, there are cases where the standard procedures need to be adjusted. For example, intensively used pumps require maintenance more often than the standard three months. The record books issued to water committees were only recently introduced, but it is already clear that they will not suit all of them – for example because they do not provide enough space for all the necessary details to be recorded, allowing registration of only 30 households. Part of the capacity building challenge for the One Million programme and the rest of the rural water and sanitation sub sector in Mozambique is to help field staff and user groups to take their management skills a stage beyond responsible implementation of the standard approaches into appropriate discretionary adjustments to specific local circumstances. Nevertheless, such adjustments should always be recorded, along with their rationale. On the other hand, where local NGOs follow non-standard procedures, as appears to be the case in Gondola district, confusion may arise and sustainability may be jeopardised.

5.5 Monitoring

Evaluation question 30. Is the Government monitoring system for community based safe water and sanitation results (including quality of services) and sustainability focused and is information used to keep track of community based services and address bottlenecks in a structural way?

The government's monitoring system for community-based safe water and sanitation results and sustainability is not yet sufficiently focused. The programme's laudable focus on monitoring has helped to develop approaches that the National Information System for Water and Sanitation (SINAS) may be able to adopt in support of PRONASAR. Much still needs to be done to build an efficient system that can keep track of the quality of water and sanitation results and the performance of community-based services in a structured way.

As was shown in section 3.2, the One Million Initiative has taken monitoring very seriously. First, it has instituted a series of annual 'sustainability checks' that assess a comprehensive series of institutional, social, technical and financial indicators across a series of sampled communities. Secondly, it has worked with community water and sanitation committees and with SDPI offices at district level to introduce record keeping and monitoring systems and procedures explicitly linked to the goal of sustainability. The latter arrangements are supported by other elements in the government hierarchy, including the administrative posts and the DPOPH. The current programme's sustainability checks are a laudable, rigorous and informative component of the One Million Initiative's overall effort to achieve effective, detailed monitoring of this complex and ambitious programme.

However, Evaluation Question 30 concerns the government's monitoring system: whether it is focused and whether it is used in a structured way. The long-term concern is whether rural water, sanitation and hygiene services and programmes will continue to be monitored effectively after the One Million programme has ended. The study finds that the government's monitoring system for community-based safe water and sanitation results and

sustainability is not yet sufficiently focused. The programme's laudable focus on monitoring has helped to develop approaches that the National Information System for Water and Sanitation (SINAS) may be able to adopt in support of PRONASAR. Much still needs to be done to build an efficient system that can keep track of the quality of water and sanitation results and the performance of community-based services in a structured way.

Monitoring should link to management at all levels in Mozambique's rural water and sanitation services. At community level, foundations have been laid for this with the registers that have been issued to water and sanitation committees. These are to be used for recording the names and financial contributions of users, as well as the technical details of pump operation and maintenance. As was noted above, this system is still in an early stage of development. It will itself have to be monitored and amended over the remainder of the One Million programme in order to optimise its format and flexibility. Furthermore, part of the long-term institutional maintenance challenge will be on-going rounds of training and advice to water and sanitation committees so that they (and their successors) become fully confident and competent in using the system.

At district level, the programme has instituted a modest but significant advance with the manual databases that now adorn many office walls in the areas where it works. The development of these databases has certainly encouraged field, district and provincial staff to think more systematically about the collection and reporting of data, and about structured action in response to what such data show. However, it focuses, understandably, on the quantitative aspects of water supply, sanitation and hygiene. It cannot capture the qualitative aspects of the multiple social, institutional and behavioural processes that determine whether the innovations will be sustainable. Local leaders and officials with the necessary skill, insight and commitment can, and to some extent do, monitor these issues. Tools and systems do exist internationally for the structured and systematic monitoring of institutional health and individuals' attitudes and behaviour with regard to hygiene and sanitation. They have not been introduced in the Mozambique rural water and sanitation sub sector.

It is uncertain at this stage whether the database system will be maintained during and beyond the life of the One Million Initiative. Its physical format does not facilitate regular updates. Having the chart on the wall for all to see is likely to raise staff awareness and stimulate more management action, but quarterly updates (based on regular data collection and submission by the PEC NGO) require complete and laborious rewriting of the chart on new sheets of paper.

Observation of monitoring arrangements developed at local levels by the One Million programme suggests that, despite promising progress, these are not yet an adequate foundation or model for a broader, longer-term monitoring system. First, as noted, community institutions are not yet sufficiently competent in financial and other record keeping. There are too many errors, gaps and discrepancies in the data that they currently record. Secondly, community monitoring is not itself adequately monitored by PEC NGOs and local government structures. The authorities are not yet sufficiently aware of or responsive to the shortcomings in community level monitoring.

Meanwhile, another kind of monitoring is widespread and valuable. In fulfilment of their various leadership and management roles, community leaders and local government staff (for example at administrative post and locality levels) often become aware of institutional or technical issues and report them for action. However, this occurs in an *ad hoc* manner rather than through a structured and focused system. Finally, an optimal monitoring system feeds information in both directions. It should not just extract the required data from community structures; it should regularly report back to them with information from the broader management system and database. This dimension of local monitoring is not yet strongly developed.

Another key dimension of local monitoring concerns water quality. There is currently no functioning system to monitor it after water points have started operation. Water quality is the responsibility of the Ministry of Health, and although test kits for basic physiochemical and microbiological tests are placed in each district, no regular surveillance is being carried out. To institute such a system across the vast rural areas and thousands of water points in Mozambique is a major challenge. DNA is aware of the issue. With the support of the One Million Initiative it is working with the Ministry of Health to develop an approach to rural water quality monitoring, in the broader context of its emerging strategy and systems for integrated water resource management (section 2.5).

The One Million Initiative's sustainability checks provide valuable ideas and experience for SINAS, but for cost reasons cannot be maintained as they stand. As noted in section 3.2, SINAS has made slow progress so far. Monitoring through SINAS was one of the fields in the water and sanitation sector judged by GOM and its development partners in their joint 2009 aide memoire to be suffering a 'serious shortage of qualified staff' (GOM and Programme Aid Partners, 2009: 33). In a related development inspired by the One Million Initiative's thorough approach to monitoring and evaluation, a national baseline survey for PRONASAR will be undertaken in 2011. This will be a vital foundation for enhanced and structured monitoring of the sector.

The ultimate challenge for SINAS and PRONASAR will be to achieve an effective link between monitoring and action. However thoroughly progress and issues are reported, the monitoring process only adds value when action is taken to address the issues that it identifies. Once again, the One Million Initiative shows examples of this linkage, notably in the actions taken in response to its first sustainability check. The challenge to PRONASAR, the DNA and local government will be make such responses routine as monitoring reports are delivered to the relevant agencies.

5.6 Summary

As explained in section 5.1 above, it is too soon to say definitively whether the benefits being achieved by the One Million Initiative are sustainable. Overall, good progress is being made towards sustainable results. But a number of weaknesses and ambiguities will have to be resolved, and major outstanding challenges overcome, if true long-term sustainable

benefits are to be realised. The achievements and challenges are identified by the study's findings with regard to the evaluation questions posed for it (Annex 1).

An appropriate national policy framework and institutions are in place in Mozambique, providing a good foundation for the sustainability of the One Million Initiative's outcomes (Evaluation Question 26). However, a number of weaknesses and ambiguities qualify the contribution that policy and institutions can currently make to sustainability. These are questions of national policy as it is applied at local level.

The first challenge is that many of the key institutional arrangements are new: there is little depth of experience with them yet. But the principal ambiguity in current arrangements concerns the economics of user responsibility. The policy expectation that communities will be able to meet the full depreciation cost of their water infrastructure is not realistic in the short to medium term.

A second major ambiguity concerns institutional maintenance and the role of NGOs. The sustainability of rural water and sanitation depends at least as much on institutional maintenance as it does on technical maintenance. It is not clear how the institutional maintenance will be sustained for the necessary decade or longer after the One Million Initiative terminates.

The important role of the private sector is qualified by the unattractive market conditions. Demand is scattered and intermittent. Clients are poorly resourced. On-going promotion and facilitation will be needed to link supply with demand. Again, current policy and institutional arrangements are insufficiently clear on these points.

Government, NGOs and the private sector do not yet have the capacity to provide and sustain the required services in the long term (Evaluation Question 27). Good progress has been made with building capacity in all three sectors. Government commitment and action with regard to absorption of programme-funded posts into its establishment are encouraging. NGO capacity is never likely to be stable; as noted above, future provision for using it is uncertain. Private sector capacity will respond to market conditions, which, as noted, are not wholly favourable.

Sustainable management of the water and sanitation facilities introduced by the One Million Initiative depends heavily on users and their community institutions. Sustainable management by communities and schools is not yet assured, despite promising progress to date (Evaluation Question 28). Especially in the context of sustaining appropriate sanitation practices – rebuilding latrines, for example, or maintaining ODF status and the vitally important latrine cleanliness and hygiene practice that should accompany it – the question of capacity blends into that of motivation at this local level. Achieving ODF status is far from being the end of the story.

One key issue is that understanding, skills and procedures are not yet deeply rooted. Commitment and enthusiasm often appear high. But the approaches and especially the administrative procedures introduced by the programme are often inconsistently or incompletely implemented. Institutional accountability mechanisms are not yet strong.

A second key challenge concerns the future of the community-based activists currently employed by the NGOs working for the One Million programme. They play a vital role, but it is not clear whether they will continue to be paid after the end of the programme. It is unlikely that they will work effectively, or at all, if they are not paid and provided with technical support.

Sustainable management of water and sanitation infrastructure at schools is easier to assure. School management structures are already in place and, with a modicum of training and support, should be able to extend their management functions to the effective maintenance of the new facilities.

Understandably, there is less assured capacity for institutional maintenance, and for the social and behavioural skills needed in promoting and maintaining appropriate sanitation and hygiene, than there is for technical operation and maintenance. National policy and the emerging PRONASAR place strong emphasis on user interests, attitudes and roles and on the importance of liaison between community leadership and local government structures in this sector. But it is too soon to be confident of sustained institutional capacity for these purposes among state, NGO and private service providers.

Several other issues affect the sustainability of the One Million Initiative's outcomes (Evaluation Question 29). Environmental factors are poorly understood, especially the potential impact of climate change. Although the geohydrology is broadly favourable, there are areas where groundwater extraction is expensive, difficult or so far unsuccessful. Increased attention to alternative technologies is planned, with some studies already under way.

The sustainability of services and the impact of benefits will be enhanced when the average number of users per water point is reduced. Understandably, communities where the One Million Initiative has recently delivered improved water supplies and enhanced sanitation arrangements are currently enthusiastic about the new infrastructure and express strong commitment to sustaining it. At this early stage, there can be no guarantee that they will. Internationally, there is little conclusive evidence about the sustainability of practices introduced through community-led total sanitation.

The government's monitoring system for community-based safe water and sanitation results and sustainability is not yet sufficiently focused (Evaluation Question 30). Indeed, SINAS will not be able to claim national coverage of water supplies before 2012, or of sanitation before 2013. Sustainable, cost-effective links between community monitoring and district data management will be necessary. In partnership with communities, NGOs and local government, the One Million Initiative has made good progress with its own monitoring systems, developing models that SINAS may be able to adopt. The programme's systems are being used to keep track of community-based services and address bottlenecks in a structural way. But continuation of these practices after the programme ends is not yet assured. As government knows, a focused and effective monitoring system must also cover water quality. Arrangements for this have not yet been developed.

These findings with regard to the likely sustainability of the One Million programme's benefits suggest a number of issues that will require further attention:

- formal clarification and restatement of policy with regard to the extent of rural water users' responsibility for the depreciation cost of their water infrastructure;
- adequate institutional maintenance for rural water and sanitation - one possibility under discussion is that PRONASAR could fund an on-going role for the NGOs that currently provide this vital service;
- linkage of private sector supply with water user demand for technical and institutional services;
- the future status of community-based activists;
- the potential impact of climate change;
- the feasibility and contribution of alternative water supply technologies;
- continued strengthening of local and national monitoring arrangements.

Over and above these points of specific attention, the unsurprising conclusion of this mid-term evaluation is that, like any major process of behavioural and institutional change, the benefits being introduced by the One Million Initiative will require years of sustained, committed effort in order to become fully sustainable. This effort will have to be shared by individuals, communities, government, NGOs, the private sector and international development partners.

Annexes

Annex 1 Terms of reference

Impact Evaluation of Government of Mozambique/ UNICEF Water Supply, Sanitation and Hygiene programme – One Million Initiative – Mozambique 2006-2013
Terms of Reference
December 1, 2009

1. Rationale, purpose and scope of the evaluation

Within the framework of the partnership between the Government of Netherlands, UNICEF and the Government of Mozambique, which aims at accelerating the achievement of the Millennium Development Goals (MDG) with respect to the access to drinking water and adequate sanitation for families and school communities, the Water Supply, Sanitation and Hygiene Programme– the One Million Initiative – is being implemented in 18 districts of the provinces **Manica** (Gondola, Guro, Machaze, Manica, Mossurize and Sussundenga), **Sofala** (Chemba, Dondo, Gorongosa, Maríngue, Muanza and Nhamatanda) and **Tete** (Angónia, Changara, Chifunde, Tsangano, Marávia and Zumbo). The programme has the duration of seven years (September 2006 – December 2013) and as a result of this partnership it is expected that until the end of the programme

- One million people in the rural areas use safe drinking water, through the construction of new sources of water supply;
- 200,000 people use safe drinking water, through the rehabilitation of their sources of water supply;
- One million people use adequate sanitation facilities;
- 1.2 million people adopt appropriate hygienic practices;
- 400 primary schools (with a total of 140,000 pupils) use infrastructures of drinking water, sanitation and hygiene;
- 18 districts and 3 provinces have strengthened technical and management capacities for the planning, coordination and implementation of programmes for water supply, sanitation and hygiene education.

The total budget for the programme is USD 42.41 million. The programme implementation strategies are aligned with the national water policy and related strategies for rural water supply and sanitation, including school sanitation, which places priority on meeting the basic needs of the disadvantaged, on decentralised management and on the participation of users. The programme approach is participatory and demand responsive, with user community and schools expected to take leadership and responsibility for the maintenance and management of their improved facilities and behavioural change, supported by Government, NGOs and private sector. The main water supply technology applied is a borehole fitted with a hand pump. An innovative component is the engagement of local NGOs to carry out promotion activities in the targeted districts to build demand for improved services, as well as capacity to sustain services and strengthen the supply side for the construction of latrines and maintenance and repair of water points. The implementation of water, sanitation and hygiene activities in the target provinces will be complement-

ed by the development and strengthening of Government capacities at provincial and district level in order to ensure long-term sustainability of the interventions.

The programme will be by far the largest in the provinces and is spearheading rural water supply policy implementation. It is the largest programme under the UNICEF – Netherlands partnership and for the Netherlands it is an important programme that is expected to contribute to its pledge to provide safe access to drinking water and sanitation to 50 million new users by 2015 as a contribution to the MDGs.

The Government of Mozambique, the Government of the Netherlands and UNICEF have agreed that an impact assessment at mid-term and at the end of the programme will be undertaken.

The focus of the assessment will be on the impact of interventions on the welfare of the target population. The ultimate purpose of the support provided to water supply, sanitation and hygiene goes beyond coverage: the support is intended to improve health, reduce the time used for collecting water – particularly for women and girls –, raise school enrolment, retention and performance of children and enable communities to improve their livelihoods. There is consensus on the importance of such ultimate impacts on human welfare but conventional evaluation studies do not usually quantify them. Quantification is a key characteristic of the proposed impact study. With the use of quantitative statistical as well as qualitative research methods the impact study will attempt to assess whether and to what extent specific interventions work and if not why not. The type of interventions such as improved water sources and hygiene education and promotion, make impact measurement after two to three years at mid-term in principle feasible.

The overall purpose of the impact assessment is to analyse the impact of interventions as well as, on the basis of the findings, derive issues and draw lessons that will be useful for rural water supply, sanitation and hygiene promotion policy and implementation. The study will include an assessment of the extent to which the institutional strategy ensures safe water schemes and improved sanitation and hygiene practices for a long period of time. The impact evaluation is also expected to contribute to methodological knowledge and capacity to undertake impact evaluation of water supply and sanitation activities.
The general impact assessment method is to compare outcome variables from programme communities or schools (treatment group) to those from communities or schools not involved in the programme (control group). A baseline survey has been designed in light of the planned impact assessment and was undertaken in 2008. The impact study will be designed as a panel study and will follow the sample based design and instruments for data collection techniques developed for the baseline survey.

The Government of Mozambique, Directorate of Water, UNICEF and the Netherlands Ministry of Foreign Affairs will jointly take responsibility for the impact assessments, through their respective policy and evaluation department.

2. Background and context of the supported programme

Mozambique is one of the most climatically vulnerable countries in Southern Africa. Over the past years, the population of the southern and central (that includes the project targeted provinces: Manica, Sofala and Tete) provinces of Mozambique has suffered the impact of various natural disasters, ranging from floods and cyclones to drought. With over 50% of Mozambique's population living below the poverty line, such shocks have dramatic consequences on the lives of the affected population. The programme area is also cyclically affected by cholera outbreaks. According to the Ministry of Health's data, more than 50% of the registered cholera cases in the country over the past three years have occurred in Manica, Sofala and Tete provinces.

Based on the assumption that a rural water point provides access to safe water for an average of 500 people, routine data indicate that the national rural water supply coverage is 48.5% (source: Directorate of water 2007). For the target provinces the rates are as follows: Manica 47.1%, Sofala 68.1 % and Tete 50.8 %. The coverage according to estimates of the UNICEF/WHO Joint Monitoring project is substantially lower. A census held in 2007 will provide reliable information on the actual coverage in the near future. The same applies for the sanitation coverage that for the target provinces and based on routine data, stands at 46.6% for Manica, 68.1% for Sofala and 53.2% for Tete.

The 2008 sustainability check undertaken in the programme indicates that on average 28% of the water supply facilities that have been constructed in recent years are non-operational (source: project document). This breakdown of water points has been attributed to various factors, including the lack of mechanisms to support users to undertake adequate preventative maintenance (such as spare parts networks close to the users); the poor quality of services delivered; low level of community empowerment to take actions; and insufficient time spent in creating demand for services (through strengthening community/family knowledge and skills in regard to safe hygiene practices and their impact on health).
The project document indicates that where latrines have been constructed at schools, over 50% of them are not operating or are not being used, either due to faulty design or incorrect construction. Feedbacks from schools and communities indicate that the lack of a child-friendly approach to school sanitation and hygiene design adversely impacts the enrolment, retention and performance of children, and in particular that of girls, since they cannot carry out their daily hygiene and sanitation practices with dignity and privacy.

This UNICEF programme is implemented in the above context and in poor and vulnerable rural areas highly impacted by the HIV/AIDS pandemic.

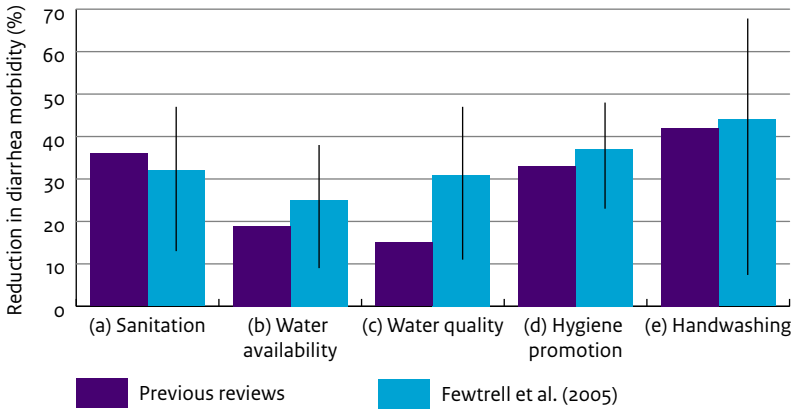
Programme theory

The limited access to adequate services of water supply and sanitation has a significant impact on the well-being and people's state of health. According to the 2003 Demographic

and Health Survey, the mortality rate of children under 5 years of age is 178 per 1000 live births (rural-192, urban-143). Among the causes for this mortality rate the most important are malnutrition (50%), malaria (18%), diarrhoea (13%), acute respiratory infections (ARI) (8%), measles (8%) and tetanus at birth (3%). The prevalence of diarrhoea in the country is 14.1% (DHS, 2003), and 20% for children under 5 years of age.

International studies show that the improvement of water and sanitation do not improve automatically people's health: it is important to add a component of hygiene education in order to guarantee the positive impact on people's health, as indicated by the figure below.

Figure 1. *Reduction of diarrhoea as a result of improvement in water supply, sanitation and hygiene (Fewtrell et al., 2005)*



According to Figure 1, washing hands correctly on critical moments is one of the most effective hygienic interventions, with reductions of diarrhoea between 42% and 47%. Increased use of safe drinking water helps to reduce the intake of dangerous pathogens existing in the water and at the same time the expected increase of water quantities facilitates the improvement of sanitation and hygienic practices. The adoption of hygienic practices by all family members is very important – like handwashing, access to and use of adequate sanitation facilities, and access to sufficient water of good quality. An important question for people's health relates to the removal and safe disposal of pathogenic human faecal material, through the use of adequate infrastructures of sanitation (latrines and water closets). The correct use of these infrastructures by the members of the family in particular, and by the community in general contributes to the reduction of pathogenic micro-organisms in the environment. Therefore, it is important to evaluate the family practices related to the use of sanitation facilities as well as the handling of children's faeces.
The impact of the reduction of time and energy spent with water collection and taking care of the affected population (in particular for those who prepare food and take care of children), reinforce the positive effects of good health in the families. In addition time savings contribute to time availability for activities, such as food provision and attending school, that impact people's well-being.

Programme approach and implementation

The actual implementation of the programme started in 2007. In the targeted provinces the programme provides for most of the budget for the rural water supply, sanitation and hygiene development. With the support of the programme each district has contracted an NGO to facilitate starting up the programme implementation through undertaking a situation assessment comparing the size of the population to existing water points and their functionality and based on that information, identifying priority communities and schools. The same NGO has been assigned to create demand for improved services and strengthen the supply side. This is being done through training of community activists; facilitation and training of water user committees and other local committees for management, operation and maintenance of their water points and for sanitation and hygiene promotion; training of artisans/masons/technicians for construction of slabs and maintenance and repair services and provision of materials that are not locally available. The sanitation and hygiene education and promotion component has a district wide focus. UNICEF has embarked on a step by step approach to building capacity of the government at provincial and district level as well as the NGOs involved. UNICEF has set up collaboration with SNV for capacity building.

With programme support up to July 2009, a total of 184 water schemes have been rehabilitated and 333 new water points have been constructed. Selection criteria for these new water points are low coverage, size of the population, demand from the communities, willingness to contribute 2% of the cost of construction and cost of operation and maintenance. Priority setting has been discussed and agreed in a meeting of the district administration with community leaders.

Policy and institutional context

The programme is implemented under the framework of Water sector reforms guided by the National Water policy (1995). At the national level the Directorate of Water of the Ministry of Public Works and Housing is the central responsible body for the water policy and sector reforms. The reforms aim at withdrawal of central government and its ministries and institutions from operational service provision, focussing on policy making and priority setting, coordination, guidance and monitoring of the sector and regulatory Implementation Manual for rural water supply. This on-going national level reform process of shifting roles and responsibilities, especially from implementation to facilitation, policy and strategy development, has not yet been complemented with the necessary and corresponding strengthening of capacities, particularly at the sub-national level (district and provincial levels) and this has been impacting upon the sector's capacity to absorb allocated funds. Capacity building, particularly at sub-national level, is currently a Government priority as the district is increasingly recognised to have the primary role in planning sector-wide activities.

3. Questions to be addressed

The impact study will investigate if and to what extent the expected effects of the programme materialise in practise, which interventions work best and explore which factors explain the findings. The impact study will also investigate whether sustainability of infrastructure and services is ensured.
The questions to be addressed by the impact study are:

Programme and context

1. What have been key problems addressed by the UNICEF water supply, sanitation and hygiene programme in Mozambique?
2. What has been the approach and specific interventions to address the problems?
3. What have been the achieved main outputs as compared to targets (nr. of new and rehabilitated water points, nr. of latrines, infrastructure at primary schools, community level water and other relevant committees, government, NGO and private sector support services)?
4. What have been the costs for key cost units and cost trends?
5. How did the institutional strategy for providing and sustaining works and services evolve?
6. Have roles and responsibilities been clearly defined? Are these adequately understood and fulfilled by beneficiaries and other stakeholders?
7. How did this strategy affect programme outputs?

Effects

Supply, sanitation and hygiene component

8. What has been the average number of users per improved water point in the sample?
9. What has been the effect on the percentage of the population that use an improved water source?
10. Have there been barriers to the access to the improved water source? If so, which proportion of households in the sample communities do not have access and why?
11. Is the improved water point the only water source for domestic use? If not which other (improved and non-improved) sources are used, when and by how much are these used and for what purposes?
12. What has been the effect on the microbiological and chemical quality of drinking water (at source and point of use)?
13. What has been the effect on the amount of water used per day per person for domestic purposes (total, from improved water source)?
14. What has been effect on the access and use of improved sanitary facilities (for men, women, and children)?
15. What has been the change in relevant hygiene awareness and practices (i.e. cleanliness of latrine; handwashing with soap or substitute at critical times; safe water storage; use of rack for cooking utensils; safe handling of baby excreta) ?

16. What has been the effect of the interventions on the health of the target population (in terms of DALYs reduction[44])
17. What has been the effect on time use for collection of water, and for which household members?
18. In what way have time savings been used (for domestic work, field work, income earning, schooling, etc.? Who are the primary beneficiaries?
19. Is the water from the improved water source used for other purposes, besides domestic purposes? If so, for which purposes and by whom?

School component

20. What has been the effect on the number and percentage of schools with a functioning safe water source in the school yard or within 200 meters from the school yard?
21. What has been the effect on the change in the number and percentage of schools with latrines (separated for girls, boys and school personnel)?
22. Do these schools have an operation and maintenance system in place?
23. What has been the effect on the use of latrines for girls, boys, school personnel?
24. What has been the effect on handwashing practices for girls, boys, school personnel (before meals and after going to the toilet)?
25. What has been the effect of programme Interventions on school enrolment and outcomes (for girls and boys)?

Sustainability of benefits

26. Are an appropriate national policy framework and institutions in place?
27. Does the government at provincial and district level, NGOs and private sector involved have the capacity to provide the required services and for sustaining services in the long term?
28. Is sustainable management of the facilities by beneficiary communities and schools ensured?
29. Are there issues that affect sustainability of benefits, not captured under question 27 and 28. Have these been addressed and with what result?
30. Is the Government monitoring system for community based safe water and sanitation results (including quality of services) and sustainability focused and is information used to keep track of community based services and address bottlenecks in a structural way?

[44] DALYs stand for Disability-Adjusted Life Years and is mostly used in international research as measure for disease burden. A DALY stands for one year of life that a person loses as a result of less good health.

4. Methodology

Following the evaluation questions an evaluation matrix is provided in appendix A, showing indicators at the different result levels, to guide data collection and analysis.

Programme and context description

Questions 1-7 will be answered largely on the basis of review of project documentation – in particular, design documents and progress reports, the remaining variables will be assessed from field data collection. These data will be collected in a field study described below. Descriptions of activities, results and costs in the official documentation will be cross checked with the descriptions given by residents of sample communities. Interviews with key informants will provide supplementary information.

Impact assessment

Interventions under the One Million initiative can broadly be divided into five areas: (1) providing safe water points; (2) increasing the number of latrines; (3) promoting improved hygiene awareness and practices; (4) providing safe water and latrines as well as hygiene education in schools; (5) capacity building. Questions 8 up to 23 on outcome and impact relate to the interventions 1 to 4. Questions 24 to 27 relate to the fifth intervention is less suitable for statistical impact evaluation and is taken up in the section on sustainability assessment.

The objective of the impact assessment is to estimate the impact of a large scale intervention on use of WASH services and changes in hygienic practices and subsequently on time savings, health and socio-economic indicators. With respect to the impact on health and socio economic indicators the focus will be on diarrhoea and cholera and the use of extra time and/ or water and financial savings on school enrolment and outcomes and livelihoods (e.g. food provision, income generation).

The intervention is large scale in the sense that the individuals affected by the programme are a big proportion of the population: as high as 50% over the course of the programme (2008-2013). The actual 'levels' or 'intensities' of the four intervention areas mentioned above will differ between sampled communities, making it possible to compare outcomes for different combinations of interventions at different stages.

The main techniques for data collection will be a sample based questionnaire at community and household level for the community level component and at school level for the school component. In principle the same questionnaires will be used as the ones used for the baseline survey. In addition available health and educational records and relevant data from the recently held census on sample communities and schools will be used.

The mid-term impact study will cover the 80 villages and schools (40 control and 40 treatment villages and schools) assessed during the baseline survey. A full intervention

history for each of these sampling units will be made available to assist in the design of the survey. Details on the design of the mid-term impact study are discussed in appendix B.

Sample of community-level interventions

Given the characteristics of the programme it could not be determined at the time of the baseline exactly which communities will be selected in the programme. However, for the provision of safe water facilities a list of communities that were very likely to get a safe water facility in 2008 or 2009, was available. The sample of these communities therefore predominantly consists of treatment communities. A sample of communities *not* in this list consists of communities which will either not receive a safe water facility (control communities) or later on in the course of the programme. Within sampled communities a limited number (20) of households was sampled to observe household-level outcome variables.

Communities not on the 2008-2009 list cannot simply be taken as valid controls for those that *are* on the list, as most of these are 'priority' communities on the basis of existing safe water facilities and population size. In order to obtain a proper counterfactual sample control communities with similar characteristics have to be sampled. Further, by estimating impact using differencing techniques the danger of selection bias is greatly reduced. Generalization of results is helped by the fact that selection of communities receiving safe water facilities is also influenced by exogenous political considerations at the district level, besides priority.

A similar stratification of treatment and control villages cannot be achieved for the other intervention areas (increasing the density of latrines, and promoting better hygiene practices). In programme districts building latrines is promoted (and subsidised) but construction is ultimately a decision of individual households and cannot be determined beforehand. Similarly, the hygiene education and promotion component of the programme is targeted at all communities in programme districts, whether they receive safe water facilities or not. Identifying the impact of latrine density and hygiene promotion is therefore dependent on sufficient variation of these interventions in the sample, given the level of safe water provision.

Definition of sampling units (clusters)

For sampling purposes a complication arises from the fact that communities have different sizes. In big communities not all households are reached by a newly provided safe water facility. Hence it will be necessary to further subdivide communities into 'clusters' of approximately 100 households. The primary sampling units (PSU) will consist of such clusters.[45] Thus a bigger community could have several clusters in the treatment and the control population.

[45] In practice, sampled PSUs will differ in (population) size. A reasonable estimate of population sizes for selected PSUs will be necessary to obtain the proper sampling weights for estimating population-level statistics.

Sampled clusters and households will be visited at the beginning (baseline), halfway the programme (2010) and at the end of the programme (2013). This panel structure will increase the internal validity of the impact evaluation by allowing the use of techniques that can greatly reduce design (grouping) effects. However, to the extent that 'early treatment' communities are not representative of all communities that will receive new safe water facilities, external validity is reduced. Sampled communities not on the 2008-2009 list can be used to judge the importance of this, since part of the communities selected as controls will turn out to be 'later treatment' villages. These can be used not only to check external validity but also to determine shorter- and longer-term impact.

Sample size

Sample size must be chosen so that a change in outcome and impact variables can be detected with an appropriate confidence level.[46] An appropriate sample would consist of 40 Primary Sampling Units PSUs (village section) randomly selected from the 'early treatment' communities, and 40 PSUs from the other communities. Within PSUs 20 households are to be selected randomly so that the total sample size is 800 for each of the (treatment and control) populations considered. Depending on how effective the panel design is in reducing the design effect this sample size allows detection of changes in a population fraction of 14% points (no reduction of design effect, D=4), 10% points (design effect effectively reduced to D=2), or 7% points (design effect eliminated: D=1). These numbers are for population fractions close to 50% and a confidence level of 95%. They become more favourable if one is willing to reduce confidence levels or if population fractions are closer to 0 or 1.

Cost considerations

Cost reductions can be achieved by sampling only from a few districts, by reducing the number of households per cluster (increasing the level of imprecision *e*), or decreasing the confidence level.
School-level interventions

The same methodology will be applied to school-level interventions.

[46] A guideline can be the formula for required sample size for clustered samples given in Bennet *et al*. (1991):

$$n = \frac{4P(1-P)D}{e^2}$$

Required sample size n is dependent on the precision aimed at (*e*), confidence levels (95%), true fraction in the population (P, usually set to the worst-case value of 0.5), and is further proportional to the so-called design effect (D). This is a measure for the degree to which households from the same PSU are more similar than households from different PSUs.

Sustainability assessment

Questions 24-27 will be answered on the basis of:
- review of documentation, including UNICEF's local level sustainability assessment reports;
- interviews with key informants at national, provincial, district and community levels;
- questions included in the field surveys undertaken in communities.

The questions span the wider spectrum of governance. The study will focus on local institutions, as this is the level of governance most critical to the sustainability of rural water supply and sanitation arrangements. However, it will also address the influence that changing structures and roles at provincial and national level may have on the implementation of the rural water supply and sanitation programme. Other topics to be covered will include:
- factors influencing variance in local water management institutions' performance and sustainability;
- the influence of multiple agencies' involvement on the implementation and sustainability of rural water supply and sanitation infrastructure and services.

5. Organisation and timing

The impact evaluation will be a joint effort of the Directorate of Water, Ministry of Public Works and Housing, of the Government of Mozambique, UNICEF and the Policy and Operations Evaluation Department (IOB) of the Netherlands Ministry of Foreign Affairs. To this end a steering group for the impact evaluation will be established, composed of a representative of the Directorate of Water, UNICEF Mozambique office and IOB. This steering group will comment on the terms of reference, research instruments and draft documents for the impact evaluation.

IOB and UNICEF will be responsible for undertaking the impact study. To this end IOB has established collaboration with the Amsterdam Institute for International Development (AIID) in view of its specific expertise in undertaking quantitative impact analysis. They will work closely together with UNICEF Mozambique in the implementation of the impact evaluation. The major activity of the study will be community- and household level data collection. This requires sophisticated quantitative data collection techniques. A substantial involvement of national researchers is envisaged, both in the data collection and in the subsequent analysis. For the sustainability assessment an additional two weeks IOB/ UNICEF (central Evaluation Office) mission at mid-term and at the end of the programme has been planned. The evaluation reports will be based on both the quantitative impact study and the sustainability assessment. Appendix B provides further information on reporting and division of responsibilities.
The findings and issues and lessons derived of the mid-term and end of programme evaluation will be discussed in a workshop with stakeholders.

The timing of the different parts of the study will be as follows:

For the mid-term assessment 2010 and end assessment 2013:

• UNICEF/IOB preparatory mission of mid-term assessment	• June 2009
• Community, household and school level data collection	• August–October 2010/2013
• Data processing and analysis	• October-November
• IOB/UNICEF two week sustainability assessment mission	• October/November
• Report writing	• December/January
• Workshop	• to be decided

Appendix A: Evaluation matrix

Objective -means	Indicators/ variables	Information sources
Input:	• Policy and institutional context • Programme objectives and 'theory of change' • Financial inputs • Technical, social, institutional and financial approaches: - Water supply, sanitation and hygiene interventions (type, number, standards); - Water user participation, gender issues, involvement of the poorest; - Institutional approach (government, NGOs, private sector, communities), contributions, support to water and other community based committees (legal, financial, organisational development, operation and maintenance, hygiene awareness and promotion etc.); - Programme planning, implementation, M&E; - Costs per key cost unit, funding, user contribution, water charges.	Policy and strategy documents Project design documents Progress and completion reports Evaluation reports Results of interviews with key informants
Output:	*Community component* • Number of (functioning) water supply as compared to targets • Number of latrines constructed as compared to targets • Number and size of communities that received sanitation and hygiene education and promotion activities • Type and number of special provisions such as for livestock, vegetable gardening, if any • Number and type of community based committees • Number of local committees/ persons that received (type of) capacity building, e.g. for operation and maintenance, administration, bookkeeping etc. (m/f) • Institutional arrangements and capacity building for support to community based WASH services: government, NGOs, private sector *School component* • Number of schools with water safe water source in the school yard or within 200 meters from the school yard • Operation and maintenance system • Number of schools with latrines (separated boys, girls, school personnel) • Number and type of committees • Number of committees/ persons that received (per type) capacity building	Project documentation Results of village level data collection Results of interviews of key informants

Outcome:	*Community component* • Number and percentage of functioning water schemes • Average number of users/ beneficiaries of improved water sources • Use of improved water sources (only improved sources used by all households, the whole year through, other sources used and by how much) • Social inclusion/exclusion of poorest households • Use of improved water sources for other than domestic purposes • Quality of drinking water (at source and at point of use) • Quantity of water consumed for domestic purposes (total, from improved source) • Number and percentage of households in sample communities with improved sanitation facility • Use of sanitation facility (men, women, boys, girls) • Improved hygiene practices (handwashing and other relevant practices covered by hygiene component) • Functioning of water and other relevant local committees: - Male/ female membership and active participation - Frequency of meetings - Elections - Contributions of members - Operation and maintenance arrangements - Breakdowns, duration of break down and how solved - Financial management: maintenance fund for payment of recurrent costs and savings for repair and replacement of infrastructure - Conflict management • Functioning of institutional arrangements for support and sustainability of community managed schemes: capacities, coordination and cooperation, water resource management, result oriented monitoring and (follow up) support *School component* • Functioning and use of improved water source (boys, girls) • Functioning of operation and maintenance system • Use of latrine (boys, girls, school personnel) • Hygiene practices: - Handwashing practices at critical times with soap or substitute - Cleanliness of latrines	National and local statistical data Results of community level data collection, focus group discussions and interviews of key informants

Impact:	• Incidence of diarrhoea and cholera, in terms of Disability Adjusted life Years (DALYs) • Time savings (gender specific) • Human capital: school enrolment and outcomes (gender specific) • Livelihood: use of extra time, water and financial savings, e.g. for food provision, income generation	National and local statistical data Results of community and school level data collection

Appendix B: Midline Data Collection: Design

The midline review has two components: survey data collection and analysis; and a sustainability study.

Survey Data Collection and Analysis.

The 2008 baseline instruments are of very high quality and should be re-used. Some amendments appear desirable. First, the long form of the questionnaire (used in 2008 for 10% of the sample) can be dropped. This will result in a substantial cost saving. Secondly, the community questionnaire can be shortened drastically: where change is unlikely (e.g. distance from the road) the question can be dropped. Thirdly, where households are asked the same question in the baseline it may be efficient to ask for the change (since 2008) rather than the level (in 2010). We suggest that a pilot is used to investigate which form enumerators and respondents are most comfortable with. The final version of the questionnaire requires the approval of IOB, UNICEF and AIID.

A complication is that some of the sample households may have left the location and, conversely, that new households may have arrived, possibly attracted by a newly established water source. The extent of such migration will be established in the focus group discussions. The most likely scenario is that there is little migration so that data collection can be restricted to the households present both in 2008 and in 2010. If, however, there turns out to be significant in-migration or there is a major attrition of the panel then adjustments are necessary.

When a household cannot be found the enumerator should find out from neighbours the reason (death, emigration, intra-location move). If the household is still in the location but not in the house it inhabited in 2008, the enumerator should retain the household in the sample. In all other cases the household will be replaced by the supervisor. The supervisor should assign one of the neighbours as replacement and give it a new household ID.

It is essential to revisit all 2008 household who have not left. In particular no clusters should be dropped to ensure that the results remain representative at the province level. Focus group discussion should lead to an estimate of population growth since 2008 as a result of immigration.

As in 2008, locations should be visited by pairs of enumerators. It is essential that no

enumerator pairs up with the same enumerator more than once. For example, location A is visited by enumerators 1 and 2, location B by 2 and 3 and so on. The 2008 supervision procedures should be amended in one respect: supervisors should check on site whether there are differences between enumerators which cannot be readily explained. One option is to enter data *in situ* and to programme a Fischer exact test in the data entry programme so as to be able to identify suspect results. The supervisor should either decide there is a legitimate reason for a difference (and then record this) or send enumerators back to check their results.

Additional data sources

Focus group discussions with community leaders and other informants should be held to cover:

- reason for revisiting (this will require great care in the control clusters)
- population changes: who came or went (since 2008) and why
- reasons for *not* using safe water sources. (There are clusters with a safe source used by none of the sample households: availability versus use.)
- more detail on use of water containers
- use of time savings (women), if any
- use of water: drinking, other uses

Aggregate health post data will be collected by UNICEF to investigate whether incidence (of diarrhoea or cholera) falls more in high intervention areas. The baseline collected data on enrolment. It is desirable to complement this with data on retention rates and exam results, both for 2008 (these data can be collected now if that would be efficient) and 2010. These data need not be collected in the field: they are available at the Ministry of Education. Again, this will be done by UNICEF.

Sustainability study

A two-week mission will be conducted to assess the (institutional) sustainability of the One Million Initiative. This study should revisit the sustainability issues at micro, meso and macro levels, namely questions 24-27 of the initial Terms of Reference GoM/IOB (2008). Question 24 can be answered using information from the community survey as well as the "sustainability check" specifically designed for the programme. However, questions 25-27 are more far-reaching and require additional investigation. In addition the study should focus on the peculiar form of conditionality embedded in the Initiative.

The One Million Initiative differs from sector budget support in the sense that the budget is not controlled by the Ministry. On the other hand implementation is fully within existing government structures. In this sense the Initiative is an interesting hybrid, avoiding the two extremes in the debate on sector support. This fits well with recent debates on conditionality, suggesting a separation between financial accountability (and very strict conditionality in that respect) and policy choices and implementation (to be left to the government). The hybrid developed in Mozambique seems promising. Assessing this issue is a major task for the sustainability study.

Reporting and Division of Responsibilities

The Ministry of Foreign Affairs will contract AIID for the mid-term impact study. AIID will contract the Maputo UNICEF office to conduct the fieldwork. In its turn the UNICEF office will contract a consultant for the field work. UNICEF will consult AIID on the selection of the consultant and the survey details. While these contractual arrangements suggest a hierarchical arrangement the study will be conducted jointly by UNICEF and AIID.
AIID is responsible for a report to the Ministry. This will cover all questions in the original Terms of Reference and will include both descriptive and statistical analysis. The description of the Initiative will be done in close collaboration with UNICEF. The institutional assessment will be done jointly with IOB. The statistical analysis will be done by AIID, in collaboration with UNICEF and if possible with involvement of the Eduardo Mondlane University in Maputo. If this collaboration involves a PhD post, as envisaged, then separate funding will be sought for this.

Based on the quantitative impact analysis report of AIID and the sustainability assessment IOB and UNICEF central Evaluation Office will prepare and take responsibility for the impact evaluation report.

References

UNICEF, 2009. *A WASH Baseline Survey Under the NL-UNICEF Partnership for WASH*: Final Report. Maputo: UNICEF.

GoN/IOB, 2008. Impact evaluation of Government of Mozambique/ UNICEF Water Supply, Sanitation and Hygiene programme – One Million Initiative – Mozambique 2006-2013: Terms of Reference

Annex 2 Estimating the number of newly realised water points under the One Million Initiative

The sample consists of two parts, (i) one representative of 9 out of 18 districts in the provinces Sofala, Manica, and Tete, and (ii) the other part representative of the communities in the same 9 districts, visited by PEC activists. See Section 4.2. The sample information includes data on water points, both existing ones and water points created or rehabilitated under the One Million Initiative, albeit at the *community* rather than the cluster level. The first part of the sample can be used to obtain estimates for the 9 districts. Those districts were not chosen for any particular reason, so a reasonable estimator for all three provinces would be to double the estimate based on the first sample part.
Sampling weights have been calculated, based on the probability that a particular community was selected. The data are given in Table A2-1 below. For each of the communities in part 1 of the sample the total number of water points created and the number of rehabilitated water points are listed. The village weight is given in the last column.

Table A2-1 Water Point Interventions 2008-2010, based on sample counts

Province	District	PA	Community	Total number of programme water points	Total number of water points rehabilitated under the programme	Village weight
Manica	Gondola	Amatongas	Zipinga	0	0	27.5
Manica	Gondola	Cafumpe	Ganhira	1	1	11.0
Manica	Gondola	Inchope	Metuchcira	1	0	13.8
Manica	Gondola	Macate	Mupuza	0	0	55.0
Manica	Gondola	Macate	Fernandes	0	0	27.5
Manica	Gondola	Matsinho	Quinta das laranjeiras	1	1	55.0
Manica	Gondola	Zembe	Maguiraze - 25 de Junho	0	0	27.5
Manica	Guro	Guro sede	Vila-sede	3	1	1.9
Manica	Guro	Mungari	Chigombe - Nhatimbueni	1	1	55.0
Manica	Sussundenga	Dombe	Sanguene	2	0	18.3
Manica	Sussundenga	Dombe	Tussene	2	0	18.3
Manica	Sussundenga	Sussundenga	Unidade	2	1	55.0
Manica	Sussundenga	Sussundenga	Mphunde	0	0	27.5
Sofala	Gorongosa	Gorongosa	Nhataca	2	0	4.2

Table A2-1 Water Point Interventions 2008-2010, based on sample counts

Province	District	PA	Community	Total number of programme water points	Total number of water points rehabilitated under the programme	Village weight
Sofala	Gorongosa	Nhamadzi	Nhambirira	1	0	4.2
Sofala	Gorongosa	Vanduzi	Nhatsapa	2	0	11.0
Sofala	Mwanza	Galinha	Nhansato	0	0	27.5
Sofala	Nhamatanda	Nhamatanda	Candiero	0	0	0.8
Sofala	Nhamatanda	Nhamatanda	Mbibir	1	0	2.9
Sofala	Nhamatanda	Tica	Nhantimbe	0	0	1.5
Sofala	Nhamatanda	Tica	nhansato	0	0	1.4
Tete	Angónia	Domue	Kunkanga	1	0	27.5
Tete	Angónia	Domue	Muenda	1	0	13.8
Tete	Angónia	Domue	Domue-Sede	1	1	13.8
Tete	Angónia	Domue	Mbewe	0	0	55.0
Tete	Angónia	Domue	Nan'kobwe	0	0	27.5
Tete	Angónia	Domue	Chirenga	0	0	18.3
Tete	Angónia	Ulongoe	Chipuiro	0	0	27.5
Tete	Angónia	Ulongoe	Mwalawabodza	0	0	18.3
Tete	Angónia	Ulongoe	M'Bemba	0	0	27.5
Tete	Angónia	Ulongoe	Mguadala	0	0	27.5
Tete	Angónia	Ulongoe	Lionde	0	0	18.3
Tete	Chifunde	Nsadzu	Nziwe	0	0	55.0
Tete	Chifunde	Mualadzi	Caputo	0	0	6.9
Tete	Tsangano	Ntengo-wambalane	Theti - Beni	0	0	27.5
Tete	Tsangano	Ntengo-wambalane	Mwalazonde	0	0	55.0
Tete	Tsangano	Ntengo-wambalane	Chicomasi	0	0	18.3
Tete	Tsangano	Ntengo-wambalane	Phonera Guera	0	0	18.3
Tete	Tsangano	Tsangano	Afutsa	0	0	18.3
Tete	Tsangano	Tsangano	Muanguete	0	0	27.5

Table A2-2 gives estimates of the total number of water points based on the data in Table A2-1, where for comparison the results have been multiplied by 2 to obtain estimates for all 18 districts.

Table A2-2 Total number of water points

Water Points Created	Total	Standard error	95% confidence interval	
All water points	833	257	313	1352
Rehabilitated	383	169	41	726
New water points	449	164	117	782

These numbers can be compared to those given in Table 7 of the main report, reproduced below.

Table A2-3 New water points and beneficiaries

	New water points (target)	New water points (actual)	% of target achieved	No. of beneficiaries enumerated
2008	280	306	109	385,456
2009	470	302	64	327,765
2010 (performance to 30 November)	406	386	95	254,523
Total	1,156	994	86	967,744

Source: Authors' calculation based on programme information and sample analysis

According to Table A2-2 the number of newly created water points is estimated to be 449 and not exceed 782. This upper bound is much below the number of new water points reported in Table 7, 994. However the latter number includes 250 boreholes created after the data underlying the estimates in Table A2-2 had been collected (August 2010). Subtracting those 250 from 994 gives 744, which lies within the 95% confidence interval in Table A2-2. Note that the number of rehabilitated water points estimated in Table A2-2 (383) compares very well with the number of 392 mentioned in the Mozambique report (Section 3.4).

Annex 3 Sampling design[47]

Introduction

The evaluation strategy for the One Million Initiative is based on a panel survey. In a programme such as this panel surveys are specifically designed to compare household and community conditions "before" and "after" interventions typically starting with a baseline survey followed by subsequent surveys. This mid-term impact evaluation survey establishes situation of water supply and quality, household sanitation and hygienic practices as well some indication of affected households socio-economic and health conditions while the programme is still going on. The evaluation strategy used is equal to the one used for the baseline study in 2008. Households visited in 2008 were, as much as possible, visited again in this mid-term impact evaluation. The general survey approach used in 2008, which is described below, is the basis of household selection for this study.

General Survey Approach

This survey used a *clustered sampling* approach where sample households were grouped into equal size population blocks. In a household survey a cluster may refer to a whole community, a whole village, or may be defined as equal size blocks into which a given community has been divided for accessibility and other practical reasons. This commonly used clustering method offers a practical approach for finding the balance between programme costs, practical applicability of statistical tools and accuracy of sample estimates. It makes the sampled units easier to access and reduces the cost of operation. Here cluster sampling is preferred because it is the approach other major international data collection exercises on water, sanitation and health such as the Multiple Indicator Cluster Surveys (MICs), which contribute to the UNICEF/WHO Joint Monitoring Programme for Water and Sanitation.

The process used for determining the sample design, particularly determining the sample size and the sample selection process, is to a large extent based on a combination of the Rapid Assessment of Drinking Water Quality (RADWQ) approach (see the UNICEF and WHO handbook,2003) and the related methodological principles and formula developed by Bennett *et al*. (see for example the publication by Bennett *et al*. 1991). Both the RADWQ and the Bennett methodologies have been applied successfully in several water quality and household health studies in developing countries. UNICEF Mozambique has extensive familiarity with both the development and use of these methodologies.

The Key Features of the Statistical Approach

The main feature that differentiates this statistical approach from a more basic simple random sample selection process is its ability to take account of the design effect caused by clustering. It is rigorous in addressing the issue of homogeneity, an issue that becomes critical once the decision is made to cluster the sample. It also pays attention to making the decisions about the desired reliability and precision of the estimates be part of determining the sample size. Bennett *et al*. for example argue that this methodology gives survey

[47] This is Annex III in WE Consult's report on the second round of the household survey.

practitioners guidance on how to get a reasonable representative sample without any great bias, and of a suitable size to give adequate precision without wasting resources. From the baseline survey, it is possible to have more confidence in the quality of estimates for various variables which means that subsequent surveys focusing on the same communities can achieve the same level of confidence using smaller sample size and paying less to complete the survey.

Application in Mozambique

The details of how this was done and the values to use for this survey were determined in a joined mission including staff of UNICEF, experts on the Bennett methodology and on RADWQ and WE-consult. It is important to note that the RADWC methodology focuses specifically on the quality of water supply with the unit of analysis being the water supply itself while the Bennett formula and methodology is developed to treat the households as the unit of analysis. This is a household survey covering water quality but also a wide range of household variables including household sanitation and hygienic practices, family health and socioeconomic conditions, education and training levels achieved and has male and female disaggregated data. The survey inception mission deliberated on how to bring the two methodologies together in the Mozambique baseline survey, and recommended an outcome that was several times discussed and accepted by the Government of Mozambique. The programme staff developed a set of indicators to be measured using a household questionnaire as well as water sampling at the source and at the household level. In addition, to improve the reliability and validity of the indicators the process included triangulation using a mixture of quantitative and qualitative methods. The aim of this triangulation was to complement the main household questionnaire with several other tools including: a community level enquiry identifying community conditions based on open discussions and a questionnaire, water source questions based on a mixture of direct observations and a questionnaire, a questionnaire administered in schools and an additional detailed household water consumption and women's labour profile questionnaire completed in some (10%) of the sampled households.

Evidently, the Mozambique baseline survey turned out to be quite comprehensive and the practical application on the ground both challenging and exciting. The project inception mission provided the methodological principles and guidelines and continued to provide reviews and inputs into the implementation process. The Consultant, using these guidelines, planned the survey, identified and implemented the practical details taking account of the required statistical rigor, programme budget and time constraints as well as limitations of rural Mozambique conditions on the ground. The rest of this paper highlights the key steps followed including defining survey population, determining the sample size, selecting the districts, defining and selecting the clusters and the final process used for selecting sample households on the ground.

Survey Population Definition and Stratification

In this survey *the population* under study is the total number of households in the 18 districts (Sofala, Manica and Tete) covered by the programme - approximately 4.9 million people in

around 1,000,000 households. Considering the nature of water collection and use, the baseline survey has adopted the definition of a household as "*all people having one household head and living on the same compound.*" The strategy for the programme impact evaluation includes future comparison of households targeted by the programme and those not targeted. For this purpose the households were stratified (or grouped by similar characteristics) into two groups – one, the target stratum including households in high density communities with limited access to improved water source and two, the rest of the households. Thus the survey includes a sample from the *target stratum* and a sample from the general population to serve as the *control stratum*. It then disaggregates the results of some key indicators by these two groups for the purpose of comparison during the base year (2008) and subsequently during mid-term (2010) and final programme impact evaluations.

Because of the different conditions of the two groups the sample was drawn from two sampling frames: one, the 1997 census data from INE (1997) used for the random selection of sample clusters representative of the control group and two, a PEC developed list used for the random selection of sample clusters representative of the target group.

Determining the Sample Size

The sample size was determined based on the following formula:

$$n = \frac{4P(1-P)D}{e^2}$$

n= the sample size (number of households in the sample)
p= the proportion of households per cluster giving a particular response for one given question (or survey item). For example, in this survey, what is proportion households (cluster average) would answer positively to washing hands after a meal.
e = the standard error of the measurement p
D = the Design Effect where D=1+(b-1) *roh
roh – rate of homogeneity (a measure of *intra-cluster* correlation regarding a given item). Roh value will be higher for items that are more likely to produce the same response for two individuals in the same cluster than for two individuals in different clusters - i.e high *intra-cluster* correlation relative to *inter-cluster* correlation.
b= average number of responses achieved to an item per cluster (where there is one response per household, b is equal to the number of households interviewed in one cluster, for example in this survey, 20)

Considering validity, precision of estimates that can be achieved given available resources, the level of error that can be tolerated for this type of study, experiences from other comparable surveys practice the following values were found appropriate for the Mozambique situation:
D = 4 (the RADWQ uses a range of 2 – 10 and the inception mission and the Bennett methodology experts agreed the value 4 is appropriate for this study given what is known and can be expected in terms of homogeneity for household factors being studied. This estimates roh = 0.2 which, according to Bennett *et al*. (1991), is reasonable).

P = 0.5 (the value of P says something about the bias of the estimator. As explained in the RADWQ handbook for implementation (2003) the value p = 0.5 maximum sample size with least bias and maximises the likelihood of obtaining a sample that is representative of the true data distribution).
e (standard error) =+ **or** – **0.05** (the value e is a measure of the estimator precision). The value e = 0.05 is typically used in RADWQ surveys based on the argument that lower precision would give unreliable results while a higher precision would be too expensive as it would require a very large survey. It is further argued that if it necessary for some reason, it is better to change the value of e than to change the value of P as one does not want a *precisely biased* estimate. The value e=0.05 gives a confidence interval of 95%.
The above values give estimates for a given item. The result is then multiplied by 4 to take account of the four main programme intervention areas forming the focus of the survey. This results in a sample size of 1600 households as follows.

$$n = \frac{4 * 0.5(1 - 0.5) * 4}{(0.05)^2} = 1600 \text{ households}$$

Sample Stratification and Representativeness

The inception mission further decided that the 1600 households should be divided into half, 800 sampled in the target group and 800 in the control group. Here it is important to note that the target group is over-represented in the sample (not sampled proportional to the size of the target stratum population) as in the population the programme does not target as many as half the population of the 3 provinces. The focus of the programme is the target group and in this survey the other households only serve as a control for the programme. Since the target group households are purposefully selected for their more limited access to water supply, the non-disaggregated average results for some specific water access related indicators such as "distance travelled," "quantity consumed" etc and their effects on the household conditions may expectedly be worse in the target group than in the control group which more resembles the overall population. Because of these facts the non-disaggregated sample results do not quite represent the conditions of the entire survey population – theoretically the results for the target group and overall sample estimates exaggerate the problem while the control group results alone more accurately capture the water access related conditions of the survey population. Thus, while the design is appropriate and statistically valid for project evaluation purpose, not all sample estimate results can be generalised to the overall survey population.

Defining clusters and Determining cluster size

The 800 households were contained in 40 clusters. The guidance given by Bennett *et al.* is that the determination of the distribution of the households within clusters should be made based on practical considerations such as access and time it would take to complete one community. In this case each cluster has 20 households and therefore 800 households organised in a total of 40 clusters. The practice in RADWQ surveys is to maintain the cluster

size between 200 and 1000 people. This survey used equal clusters of 500 people (100 households). On the ground this arrangement meant that each cluster was covered in a period of 3 days.

District Selection: The 9 districts covered in the study were purposefully selected for their convenience in the execution of the survey and amount to a good coverage of the total programme area. The reasons for selecting them include the fact that programme work was going on and so more was known about the communities. However to the best of existing knowledge the household and water supply conditions of the households in the 9 districts does not differ in any systematic way from the rest.
Sample Cluster Selection: Cluster selection was followed by *systematic random cluster sampling*. This process required that first the total population of the communities (in INE 1977 census for control and PEC for target) in the 9 districts was divided by 500 to obtain the number of clusters per district with each district having a different number of clusters reflecting its population size. The following steps were followed to select clusters in each of the groups as follows:

Cluster selection steps

STEPS	Target Cluster result	Control cluster result
1. Consistent with the PPS systematic random sampling a *cumulative list* of clusters was created for each group	376 clusters	2200 clusters
2. The total number of clusters was divided by 40 to obtain the *sampling interval*	sampling interval = 9	sampling interval = 55
3. A first random number was chosen between 1 and the sampling interval.	*First random number* =6	First random number = 49
4. after the *first random number* the *sampling interval* was added to identify each subsequent sample cluster and the total number of sample clusters per district obtained.	total number of sample clusters per district obtained	total number of sample clusters per district obtained
RESULT	**40 clusters**	**40 clusters**

This first stage of sampling sampled clusters as the primary units following the Probability Proportional to Size (PPS) approach and resulting in the number of sampled clusters being more in higher population districts.

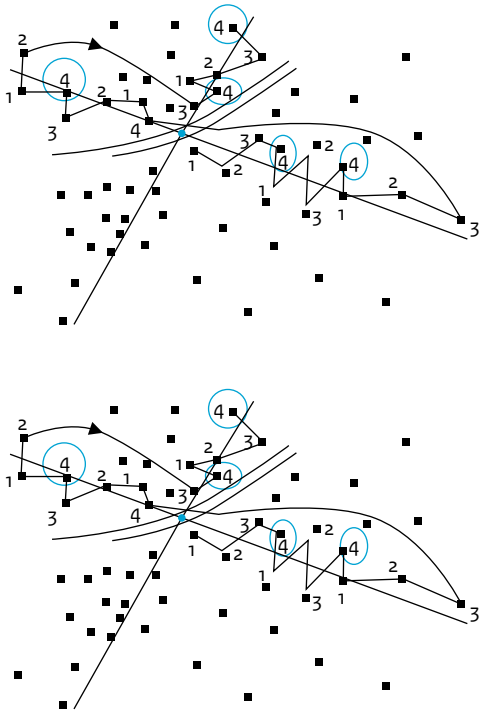
Selecting households in the field

Bottle spinning- start point: In each cluster the initial random effect was achieved by the *spinning of a bottle* while standing at the middle of the cluster and taking the line of the bottle top as the start. This gave every household in the cluster equal probability of being on this line. It then used randomization procedures to select the first and subsequent households while addressing different cluster patterns.

This final part summarises the steps followed and guidance given (to the field team leaders and enumerators) for addressing different cluster shapes and house densities and for avoiding likely bias of selecting more households in the middle of cluster or along the village road or path.

Case I: Sampling Approach in a Dense and round or square shape cluster

Diagram 3: Example of Square High Density Cluster



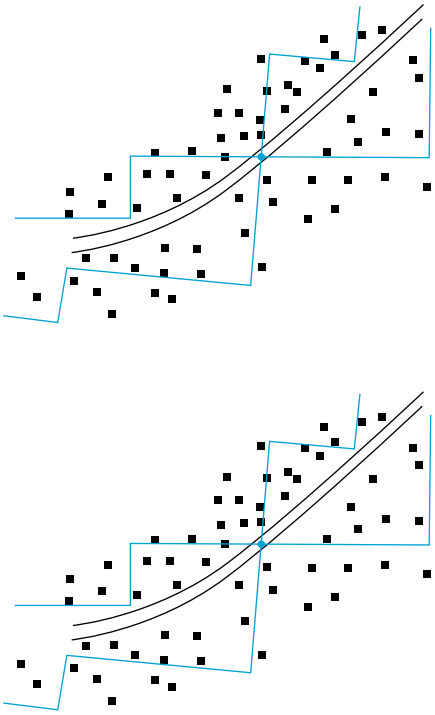
Steps (see diagram 3):

1. Establish the approximate cluster boundaries and start at the centre (in target communities this was the identified location of water point)
2. From the centre spin a bottle, follow the line indicated by the bottle top and select the first household using the given random number between 1and 4. The random number for the start household given to each team leader was different in each cluster. Out of 20 households to be selected this became house number 1.
3. Along the same first random line, count the 4th house after house number 1 and call this house number 2 and continue selecting and numbering every 4th house until the cluster boundary.
4. Select subsequent houses by going back to the centre and continuing the selection of every 4th house along the same line in the opposite direction (180 degrees) until cluster boundary.

5. Return to the centre, take 90 degrees line from the first line and continue counting every 4th house towards cluster boundary and then back to centre and continue same procedure in the opposite direction.
6. Continue this until 20 households have been selected.

Case II: Sampling Approach in High Density Cluster Elongated Along Road

Diagram 4: Example of Elongated High Density Cluster



The objective here was to minimise both the bias of being located along the road, in the middle or near water point and to have best coverage in the cluster.

Steps (see diagram 4):

1. Establish the approximate cluster boundaries and start at the centre
2. From the centre spin a bottle and following the line indicated by the bottle top select the first household using a random number between 1and 4. Out of the 20 households that need to be selected this is house number 1.
3. Along the same line house number 2 should be the 4th house from the 1st one. Continue selecting each 4th house until the cluster boundary.
4. At the cluster boundary turn 90 degrees and continue counting and numbering every 4th house

5. When you get to the end or to the road take 90 degrees again and select every and number 4th house.
6. Return to the centre, take 90 degrees line from the first line and continue counting every 4th house towards cluster boundary or road. At that point take another 90 degree turn and continue counting and numbering.
7. Return to centre and take a line perpendicular to the first one and continue the same pattern until 20 households have been selected.

Case III: Low Density Square/round or Elongated Clusters

Following the same line patters and procedures as in case I (high density square or round) or case II (high density elongated) but in this case because of longer distance between houses, count every house (not every 4th house) along each selected line.

Annex 4 References

Alfai, I., 2010. *Opportunities and prospects of using the Common Fund in the rural water supply and sanitation subsectors in Mozambique.* In Smit *et al.*, 2010: 3-4

CDC, 2010. *Mozambique: HIV/AIDS assets and strategic focus*. http://www.cdc.gov/globalaids/Global-HIV-AIDS-at-CDC/countries/Mozambique/ [accessed 3 December, 2010]

Esrey, S.A., 1996. Water, waste, and well-being: A multicountry study. *American journal of epidemiology*, 143 (6), 608-623

European Commission, 2006. *Country environmental profile for Mozambique – final report*. Brussels: European Commission. http://ec.europa.eu/development/icenter/repository/CEP_Mozambique_200607.pdf [accessed 1 December, 2010]

Fox, L., Bardasi, E. and van den Broeck, K., 2005. Poverty in Mozambique: unravelling changes and determinants. Washington, DC: World Bank Africa Region *Working Paper series* 87

Fewtrell, L. and J.M. Colford, 2004, *Water, Sanitation and Hygiene, Interventions and Diarrhoea, a systematic review and meta-analysis*, World Bank, 2004

Fewtrell, L., Kaufmann, R., Kay, D., Enanoria, W., Haller, L. and Colford, J.M., 2005, Water, sanitation, and hygiene interventions to reduce diarrhoea in less developed countries: A systematic review and meta-analysis. *Lancet infectious diseases*, Vol. 5, p.42-52

Godfrey, A., 2009. *Preliminary documentation and evaluation of the sanitation component of the 'One Million Initiative' in Mozambique.* Maputo: WSP, The World Bank

Godfrey, S., Muianga, A., Amaro, M., Fernandez, P. and Sousa Mosies, L., 2009. Sustainability check – *a monitoring tool for the sustainability of rural water supplies.* Paper presented to 34th WEDC International Conference, Addis Ababa

Gökgür, N. and Jones, L., 2006. *Privatization of Mozambique water sector.* Boston: Boston Institute for Developing Economies

GOM, 2001. *Rural water supply project implementation manual.* Maputo: Rural Water Department, National Directorate of Water, Ministry of Public Works and Housing

GOM, 2006. *Action plan for the reduction of absolute poverty 2006 - 2009 (PARPA II)*. Maputo: Council of Ministers

GOM, 2009a. *Summary: multiple indicator cluster survey, 2008.* Maputo: National Statistics Institute.http://rochr.qrc.com/bitstream/123456789/2936/1/MICS_Summary_English_201009.pdf [accessed 2 December, 2010]

GOM, 2009b. *Report of the Mozambique Triangulation Project: synthesis of data on trends in the national and local HIV epidemics and the reach and intensity of prevention efforts: process, key findings and recommendations.* Maputo: National HIV/AIDS Council.

GOM and Programme Aid Partners, 2009. *Joint review 2009. Aide-memoire.* Maputo: 27 April

GOM, 2010a. *Quadros do 3º censo geral da populaçaão e habitação 2007*. Maputo: Instituto Nacional de Estatística. http://www.ine.gov.mz/censo07 [accessed 30 November, 2010]

GOM, 2010b. P*overty and wellbeing in Mozambique: third national poverty assessment.* Maputo: National Directorate of Studies and Policy Analysis, Ministry of Planning and Development. http://aec.msu.edu/%5C/fs2/mozambique/caadp/THIRD_NATIONAL_POVERTY_ASSESSMENT_october1.pdf [accessed 2 December, 2010]

GON, 2010. *UNICEF – Government of the Netherlands co-operation programme on water supply, sanitation and hygiene promotion, Mozambique: 'One Million Initiative': programme review mission 2010.* The Hague: DGIS. Draft report

GON and UNICEF, 2006. *The Government of the Netherlands – UNICEF partnership: water, sanitation and hygiene. Mozambique project proposal.* The Hague and New York: GON and UNICEF. Revised July 2006

Hutton, G., and L. Haller, 2004. *Evaluation of Costs and Benefits of Water and Sanitation Improvements at the Global Level.* World Health Organization

Howard, G. and J. Bartram, 2003. *Domestic water quantity, service level and health.* Geneva: WHO. Independent Evaluation Group (IEG), 2008. What works in water supply and sanitation: lessons from impact evaluation. Washington, DC: World Bank

McSweeney, C., New, M. and Lizcano, G., nd. Mozambique. *UNDP Climate Change Country Profiles.* Oxford: School of Geography and the Environment, University of Oxford. http://country-profiles.geog.ox.ac.uk/index.html?country=Mozambique&d1=Reports [accessed 8 December, 2010]

Massuanganhe, I.J., 2005. Decentralisation and district development: participatory and multi-sectoral framework for decentralised policies and local development strategies addressed to Millennium Development Goals. Maputo: UNDP/UNCDF Decentralisation and Local Governance Programme *Working Paper* 3

Movik, S. and Mehta, L., 2010. The dynamics and sustainability of community-led total sanitation (CLTS): mapping challenges and pathways. Brighton: STEPS Centre: *STEPS Working Paper* 37. http://www.steps-centre.org/PDFs/CLTS_web.pdf [accessed 9 December, 2010]

PRONASAR, 2010. *Sector parameters for the estimation of WSS coverage.* Maputo: DNA: minutes of meeting held on 12 November

Prüss-Üstün, A., R.Bos, F.Gore, J.Bartram, 2008. *Safe water, better health: costs, benefits and sustainability of interventions to protect and promote health*, Geneva, World Health Organisation

Smits, S., Lockwood, H., Danert, K., Pezon, C., Kabirizi, A., Carter, R. and Rop, R. (eds.), 2010. *Proceedings of the International Symposium on Rural Water Services: providing sustainable water services at scale. 13-15 April, 2010. Speke Resort Munyonyo, Kampala, Uganda*. http://www.scalingup.watsan.net/page/346 [accessed 6 December, 2010]

UNAIDS and WHO, 2008. *Epidemiological fact sheet on HIV and AIDS: Mozambique: 2008 update.* Geneva: UNAIDS/WHO Working Group on Global HIV/AIDS and STI Surveillance.

UN Data, 2010. http://data.un.org [accessed 23 November 2010]

UNDP, 2010. *Explanation note on 2010 HDR composite indices: Mozambique: explaining HDI value and rank changes in the* Human Development Report 2010. Maputo: UNDP http://hdrstats.undp.org/images/explanations/MOZ.pdf [accessed 2 December 2010]

UNICEF, 2009. *UNICEF – Government of the Netherlands partnership: water, sanitation and hygiene: 'One Million Initiative': country progress report: Mozambique.* Maputo: UNICEF

UNICEF, 2009, *Sustainability check UNICEF – Government of the Netherlands partnership: water, sanitation and hygiene: 'One Million Initiative',* Mozambique. Maputo: UNICEF

UNICEF, 2010a. *UNICEF – Government of the Netherlands partnership: water, sanitation and hygiene: 'One Million Initiative': country progress report: Mozambique.* Maputo: UNICEF

UNICEF, 2010b. *Child Friendly Schools Programme: schools infrastructure component.* Maputo: PowerPoint presentation

UNICEF, nd (a). *Programme brief: WASH – community approach to total sanitation (CATS) in Mozambique.* Maputo: UNICEF

UNICEF, nd (b). *Programme brief: WASH – cost effective drilling.* Maputo: UNICEF

Waddington, H. and B. Snilstveit, 2009. "Effectiveness and sustainability of water, sanitation, and hygiene interventions in combating diarrhoea." *Journal of Development Effectiveness* 1(3): 295 - 335

WASHCost, 2010. *WASHCost Update* 3. The Hague: IRC International Water and Sanitation Centre

WE Consult, 2009. *Baseline survey final report. A WASH baseline survey under the NL-UNICEF partnership for WASH: One Million Initiative.* Maputo: WE Consult for UNICEF

WE Consult, 2010. *Mid-term impact assessment data collection report, a survey under the NL-UNICEF Partnership for WASH: The One Million Initiative Programme*. Maputo: WE Consult for UNICEF

WHO-UNICEF, 2006. *Core Questions on Drinking-Water and Sanitation for Household Surveys*. Geneva: World Health Organization and UNICEF

WHO, 2006. *Country health system fact sheet 2006: Mozambique.* http://www.afro.who.int/index.php?option=com_docman&task=doc_download&gid=1271&Itemid=2111 [accessed 2 December, 2010]

WHO, 2011. http://www.who.int/water_sanitation_health/hygiene/envsan/phastep/en/, accessed February 2011

Woersem, B. van, Zijlstra, P.J. and Juizo, D., 2007. *Country report: Mozambique: IOB evaluation water sector.* The Hague: IOB, Ministry of Foreign Affairs

World Bank, 2007. *Mozambique country water resources assistance strategy: making water work for sustainable growth and poverty reduction*. Washington, DC: The World Bank

World Bank, 2010. *Mozambique*. http://data.worldbank.org/country/mozambique [accessed 30 November, 2010]

WSP, 2007. *Training of trainers' manual on community-driven total sanitation. Module 1: guidance notes*. New Delhi: WSP-South Asia. http://www.wsp.org/wsp/sites/wsp.org/files/publications/Guidance_Book_24Jun08.pdf [accessed 18 December 2010]

WSP, 2010. *Water supply and sanitation in Mozambique: turning finance into services for 2015 and beyond. An AMCOW country status overview.* Nairobi: WSP, The World Bank for the African Ministers' Council on Water: final draft

Zwane, A. P. and M. Kremer, 2007. "What Works in Fighting Diarrheal Diseases in Developing Countries? A Critical Review." *The World Bank Research Observer* 22(1): 1-24

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Since 2006, the UNICEF–Netherlands Partnership Programme for Water Supply and Sanitation has been supporting Water Supply and Sanitation programmes in Mozambique. The largest programme, the 'One Million Initiative' aims to bring improved sanitation and clean water to over one million people in rural Mozambique. Half-way through the programme, a joint impact evaluation was carried out by IOB and UNICEF's evaluation office. It found evidence of a large increase in the use of improved water sources and in the ownership and use of latrines. Much of the increase can be attributed to an innovative approach to sanitation. However, water from improved sources and even more importantly, stored water, are not always safe to drink. An element of subsidy will continue to be needed to sustain facilities and services.

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